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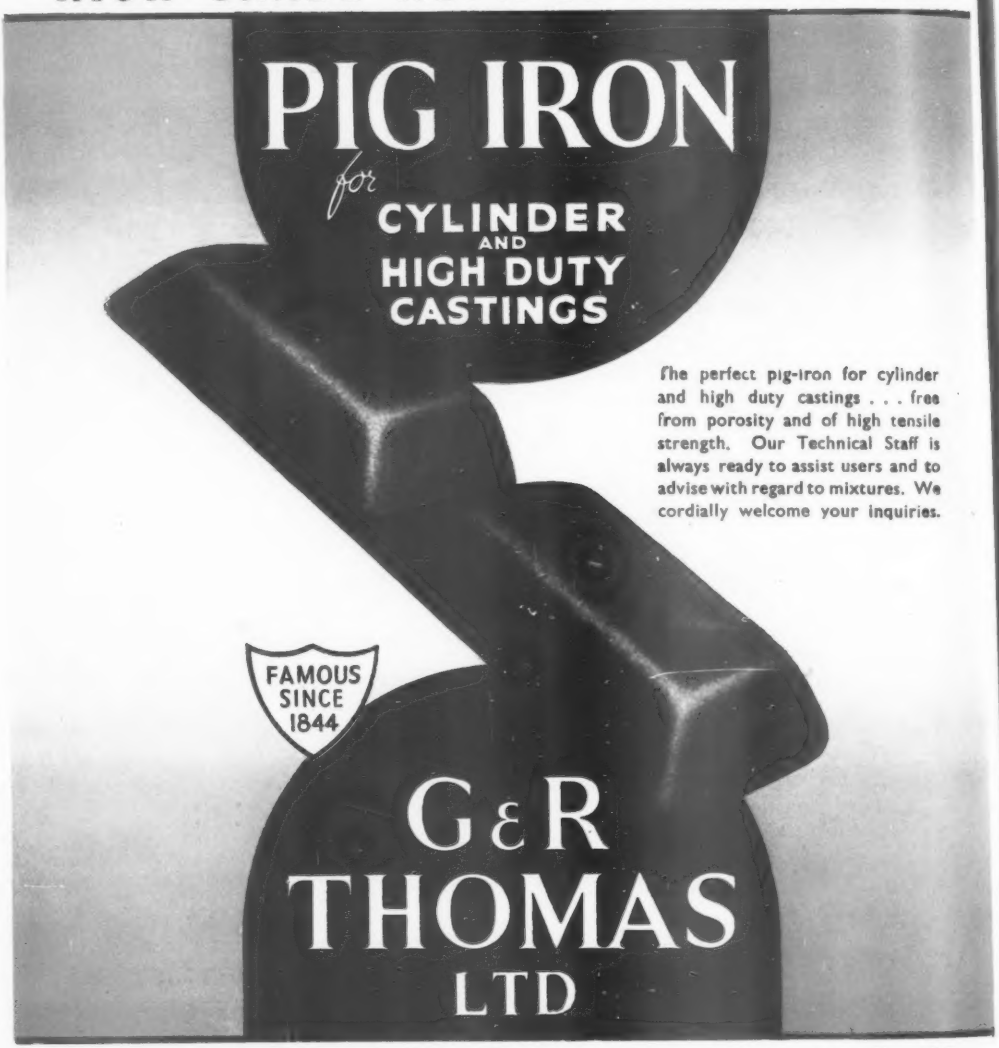

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Foundry Pig

According to the second annual report of the Iron and Steel Board, the steel industry improved its production in 1955 by six per cent. over the previous year, which is distinctly better than the 4.9 per cent. increase in the production of iron castings. One table shows that the import of steel castings has been gathering momentum, and has risen from 1,400 tons in 1953 to 2,200 tons in 1955. Of itself this figure is not very important, as that year production was 286,000 tons, but read in conjunction with the statement that exports by steelfounders were 11 per cent. lower than 1954, then it has some significance.

Next we learn that in 1955, the iron foundries consumed 3.14 million tons of scrap or 175,000 tons more than in 1954. Pig-iron, the other major metallic raw material for foundries, is of special interest and reference is made in the Report to shortages during 1955, and it is pleasing to read: "The Board said in their Development Report that there was a need for the modernization of the foundry iron industry. In the main, the developments and improvements in pig-iron manufacture since the war have taken place at plants producing basic iron for steelmaking. There has been less change at foundry iron plants. Some of these consist of small and old furnaces which are likely to have a very limited life and in certain cases the sites are under disadvantages which prevent efficient and economic development. During the year, the Board made a special study of the industry and visits were made to almost all works. An estimate was made of the need for new capacity to replace obsolescent plant and to meet the expected increase in the requirements of low-phosphorus foundry iron. The results of the investigation were discussed with the Council of Iron Producers representing the firms concerned with foundry iron manufacture. Certain proposals were put before the Board during 1955 and the Board gave their consent to a scheme for the complete modernization and extension of the Gartsherrie Ironworks of Bairds & Scottish Steel, Limited. The Board have also given their consent to the installation of a mechanically-charged 20-ft. furnace to replace a small hand-charged furnace at the Millom & Askam Hematite Iron Company, Limited. This will enable the company considerably to expand their production of hematite iron which will be used partly in the production of iron castings and partly in steelmaking. Other foundry iron schemes have since been under consideration."

The problem is not easy of solution. With the great furnaces making pig-iron for the steelworks, the liquid metal is charged into the steelmaking furnaces and the vast quantities of gas produced are used either to generate electricity, or employed (often mixed with coke-oven gas) for firing furnaces in and about the works, or sold in bulk to the branches of the Gas Board. In contradistinction,

Foundry Pig

the smaller foundry-iron furnaces are usually not too integrated, yet nowadays much can be done to use the waste gases economically, and so bring down the prices of pig-iron to levels which will enable the products of the iron and steel founders to compete with those of foreign countries.

Administration of Metal Industries, Limited

Sir Charles Westlake, the new chairman of Metal Industries, Limited, concludes his statement, to be given at the annual meeting on October 9, by saying that present trends show "a heartening measure of recovery." He also points out that many of the recommendations contained in Cooper Bros. & Company's report on the group's affairs have been implemented and action begun on others.

When the serious decline in profits and the trend of the group's finances were apparent, Sir Charles states, Cooper Bros. & Company, chartered accountants, was invited to conduct an independent investigation into the group's affairs. A summary of the main conclusions and the recommendations of the report accompany Sir Charles' statement. They refer to weaknesses in the general form of administration allied to certain basic faults in the carrying on of the group business. "As a result of directives given without appreciation of their effect, bad accounting, inaccurate budgeting and costing, and rapid changes in policy," there had been a serious deterioration in the businesses of the group. There was no follow-up system in force to see that directives were put into operation.

In the engineering field, in the case of both Fawcett Preston & Company, Limited, and Sentinel (Shrewsbury), Limited, years of insufficient capital expended on keeping the plant up-to-date were followed by the expenditure of large sums without adequate planning.

The additional funds made available by the sale of £600,000 British Oxygen ordinary stock, together with an increase of some £900,000 in the overdraft, has been utilized to increase group fixed assets by £586,871, stock and work by £782,757 and debtors and advance payments by £572,362. The proceeds from the sale of Sentinel (Shrewsbury) to Rolls-Royce, Limited, eliminated the group's overdraft and left it in a position to develop its remaining interests.

A recommendation, Sir Charles continues, that the 1954-55 accounts be recast because group reserves were previously overstated was accepted. The effect was to reduce group reserves at March 31, 1955, by £867,352, to reduce tax liability by £36,203 and to eliminate the item of £903,555 appearing as excess over par values of holding company's book value of subsidiaries' shares.

Cooper Bros. also recommended that there should not be a revaluation of shares in subsidiaries at March 31, 1956, and the consideration of this to be postponed until plans for restoring them to a profit-earning basis had been carried out.

QUALCAST, LIMITED—Record group trading profits of £1,001,412 for the year to June 30—an increase of £33,000 over the previous year's peak—are announced by the company. The 24 per cent. dividend total on the ordinary capital as increased by a 10 per cent. scrip issue is maintained, an unchanged final dividend of 16½ per cent. being recommended.

Retirement of Basil Gray

Mr. Basil Gray, a director of English Steel Corporation, Limited, is retiring at the end of this month from executive duties and is relinquishing his appointment on the board. Mr. Gray was educated at Winchester and Cambridge, where he took a special degree in engineering and modern languages. He started with Vickers, Limited, Sheffield, in 1910, on a pupil course and subsequently held positions in the armour piercing shell, bar mill, drop forge and oil-well supply departments. On the formation of English Steel Corporation, Limited, in 1929, he was placed in charge of the central estimating department and was later appointed technical assistant to Col. Neilson and Mr. G. R. T. Taylor. In 1934, he was appointed superintendent of Grimesthorpe Works and was responsible during the war period for foundry production including large quantities of armour castings and "Grand Slam" bombs. At the end of the war he assumed responsibility for engineering arrangements for all works and he was appointed a director in 1946. Mr. Gray has been a member of the Admiralty War Technical Committee, Ministry of Supply Rolled Armour Committee, Ministry of Supply Cast Armour Committee and the Mechanism of Freezing Panel of the BSFA Research and Development Committee. He has also been chairman of the BSFA committee dealing with health conditions in foundries. In 1947 Mr. Gray visited the USA to present to the American Foundrymen's Society an exchange paper on the manufacture of Grand Slam bombs and, in April of this year, he read at meetings of the Iron and Steel Institute in London and Paris a paper, which was very favourably received, on the effect of gravity in the solidification of steel. Mr. Gray is a grandson of the late Mr. Albert Vickers and belongs to the sixth generation of the Vickers family which has served English Steel Corporation, Limited, and its predecessors.

Forty Years Ago

In the September, 1916, issue of the JOURNAL, the Editor in making a plea for the foundation of a research association for the foundry industry, indulged in a little woolley thinking, as he stressed too strongly the secretiveness of the founder and the need for work to be carried out on coking. He should have pointed out the huge field for co-operation as the products of the vast majority of the founders were rarely in competition with one another. The reason for his dealing with this subject was the publication of the first annual report of the committee for Scientific and Industrial Research. Copper was quoted at £110 a ton, tin at £171 and lead £31; Welsh or Durham foundry coke cost 53s. delivered in London, and Cleveland No. 1 pig-iron £4 11s. 7d.

THE *Association Technique de Fonderie* announces that its 30th Congress will be held in Paris at the end of May and beginning of June, 1957.

Düsseldorf Diary

By A. R. Parkes

(*Continued from page* 319)

This section deals with the second half of Congress week, Friday's banquet and the closing sessions on Saturday, September 8. *The reader is then taken on tour A, one of the three post-congress tours, covering the period September* 9 *to* 15, *during which there was a further series of works visits and a number of social gatherings.*

Thursday, September 6

Thursday was free from organized works visits, so that members could attend the technical sessions or tour the exhibitions, the majority again choosing the latter though some of the papers received good attendances.

Special Visit

The writer also had intended to spend the whole day in the exhibitions but by the kindness of one of the principals was invited first to the International Harvester foundry at Neuss. The special purpose of this visit was to inspect continuous moisture control for the sand system (see Fig. 1), which had newly been put into operation and was reported to be giving very satisfactory results—that is, in terms of more uniform sand at the moulding stations. Called the Hygrotester and made by Paul Lippke of Neuwied in the Rhineland, the apparatus consists of a capacitator using h.f. current installed in the weigh hopper for the return-sand supply to the mill. This records the moisture automatically and relays the information to control the water addition in the mill, also taking into account the temperature of the sand (the latter recorded from a thermocouple inserted at the base of the return-sand hopper). The capacitator plates, arranged vertically, are about 3-in. deep and 10-in. wide.

In this plant, the additions (coal-dust and bentonite) are also metered into the two Speedmullers, these having been supplied by Herbert Morris, Limited. Other variables, which it is hoped partially to counter with the new control system, are the effect of wide temperature variation—20 to 70 deg. C. in the return sand—and the loss of moisture consequent on conveying the warm, reconditioned sand for different distances in the foundry. The sand silos here have the usual rotating-base and plough-off to the weigh hopper. A useful innovation is the provision of mechanical stirrers in the additions hoppers. The sand-control systems (one for each Speedmuller) incorporate an illuminated flow-diagram of the system, in addition to the usual interlocking controls, these were installed by Emil Niethammer of Stuttgart, who had a stand in the Düsseldorf exhibition. The cost of the moisture control systems approximated £1,400 each.

Other items noted in this plant, though only a minute section was inspected, was the method of tipping medium-weight moulds for pouring on the roller conveyor at an angle of about 10 deg. This was done by means of fixed lever/lift devices installed at the side of the conveyor which engaged with and tilted the plate carrying the mould. Also at this works are two new horizontal continuous sand mixers awaiting installation. These are made by Junkerath Geiverkschaft and consist of vee-belt driven drums about 40-in. dia. by 10-ft. long carried on rollers; mixing is effected by spiral internal vanes; there are also two longitudinal driven spindles inside the drums presumably carrying toothed ploughs. For these, the sand supply is to be from overhead through a bifurcated chute. The same system of moisture control is also to be installed on these mills. Another point noted on this plant was that overhead exhausting from one of the knock-outs has been discontinued, apparently in favour of side suction. The hoist system employed in this foundry for large ladles (10 cwt. approx.) comprised a rather bulky—probably because of the protective case—electric hoist built into the ladle suspension. Although one would think the hoist would quickly become overheated, the system appeared to be working well.

Friday, September 7

Returning to Düsseldorf late on the Thursday morning, the writer stayed in the exhibitions until they closed and yet still had not seen by any means everything. However, as he had only a half-day works visit planned for the following day, Friday, it was hoped to spend the remaining time again in the exhibition. As it transpired, the trip made on that day to Bergische Stahlindustrie KG at Remscheid* was so interesting and the luncheon kindly provided by the firm so protracted that the return to Düsseldorf was not made until 6.30 p.m., leaving but scant time for preparing for the annual banquet.

On Friday, also, official parties from Congress delegates were received at the works of Buderus'che Eisenwerke; Metallwerk Hundt & Weber AG; Deutsche Dochler-Guss-Werke GmbH; Rokal Guss-und-Armaturenwerk GmbH; Honsel-werke AG; Ruhr; International Harvester Company; Postel-Spritzguss Gebr.; Eisenwerk Brühl GmbH; and Quarzwerke GmbH/Rheinische Sandwerke GmbH. There was also a number of visits duplicating those to various firms named earlier in this report.

Congress Banquet

Approximately 1,300 members and their ladies in addition to works representatives, civic and industrial dignitaries, attended the Congress banquet

* Shortly to be described.

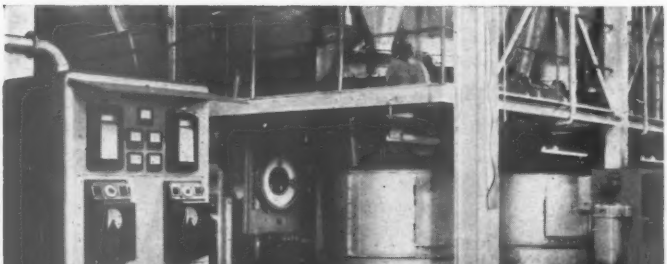


FIG. 1.—*Installation of Hygrotester equipment for automatic moisture control of sand at Norrahammars Bruk AB, Sweden—somewhat similar to that at International Harvester, Neuss, Germany.*

and ball. This brilliant function was but little marred by the embarrassingly large attendance, though this necessitated the elimination of an official reception by the president and resulted in the function being held in about five halls of the *Rheinterrasse* instead of the *Rheinhalle* as arranged. It was not so formal as that held in London and only three short speeches were made, these being relayed in the three principal languages to all the halls. The first was from Dr. Schwietzke, proposing a toast to the ladies, saying how important were their ministrations to the menfolk, returning tired from their work in the foundry. Mr. Vuilleumier, the International Committee president, then said a few words of commendation, ending by welcoming all the delegates, in even greater numbers, to the 1960 Congress to be held in his home country, Switzerland. Finally, the president of the Japanese Foundry Association presented a fan and silk scarf to Mrs. Schwietzke as a token of goodwill and appreciation of hospitality. Dancing continued until the early hours, separate bands playing in the different halls. (Fig. 2 shows scenes at one of the earlier receptions of the Congress.)

Closing Sessions, Saturday, September 8

The closing session of the Congress, held in the Robert Schumann Hall, was both simple and dignified. Nearly all of the International Committee member nations were represented on the platform by their official delegates, with Dr. Ing. Schwietzke occupying a central position, flanked by Mr. Vuilleumier, president of the International Committee; Dr. A. B. Everest, the vice-president and Mr. G. Lambert, the secretary. About 300 Congress members and ladies attended.

The proceedings were ushered in by a short concert by a string orchestra and then Dr. Schwietzke introduced the president to the meeting. Mr. Vuilleumier summarized the activities during the past week of the various committees within the organization and reported the results of their deliberations including announcements about new members. Thus, he said, the Austrian Foundry Association had been admitted to membership from the commencement of that Congress, membership of Yugoslavia will date from January 1, 1957, the entry of Polish and Czechoslovakian founders is in negotiation and the application from Israeli foundrymen has been referred back for further information. If all are admitted, the International Committee will be 20-nation strong (surely a record for any industrial technical association). In closing these remarks, the president drew special commendation upon the work of Dr. Everest and Mr. Lambert and returned warm thanks to Dr. Schwietzke and Mr. P. Schneider—the VDG secretary—congratulating them on the excellence of the organization of the whole Congress.

Perseus Award

Next, the president cited Mr. Johannes Croning as the recipient of this year's Perseus International Award, as being the most worthy member of the German foundry industry of the period. Mr. Croning had been nominated for his pioneer work in developing the sand/resin shell-moulding process which carries his name or initial. Mr. Croning, though not in the best of health, was present to receive the award—the Perseus bronze statue, modelled on that of Benvenuto Cellini, to hold for one year and a smaller model in perpetuity. Afterwards he voiced his appreciation of the honour accorded him.

In his closing speech, Dr. Schwietzke added a few words in praise of Croning's work and then went on to declare the proceedings at an end, after first thanking Mr. Vuilleumier, Dr. Everest, Mr. Lambert, the NOVEA and GIFA organizations and other important bodies in Düsseldorf, the works' executives and the civic authorities, all of whom had contributed in making the Congress so successful. Finally, after *Auf Wiedersehen* in six languages, there was a further interlude of appropriate orchestral music and the assembly broke up. Thus ended a very well-organized Congress, admirably carried through in all its major detail.

The next International Foundry Congress (jointly sponsored by the Scandinavian group of countries) will be held in Stockholm from August 19 to 24, 1957. In 1958, there will be a Congress in Belgium and in 1959 in Spain, in 1960 in Switzerland and in 1962 in the USA (so far the

venue for 1961 is not settled). Fourteen days before the Düsseldorf Congress opened, 3,000 registrations had been received, 1,770 of them from 30 other nations than the hosts. As it transpired, at least 4,000 members of affiliated foundry organizations attended the Congress and, of course, thousands of others as well as the general public visited the exhibitions. The UK delegation alone, in topping the 200 mark, must represent the largest ever exodus of foundrymen from this country.

The writer spent the remainder of Saturday, September 8, in the Düsseldorf exhibitions. These were more than ever crowded; it seemed as if each of the local works had each sent in a quota of enthusiastic visitors and the demonstrators were kept busy right from 9 a.m. to 6 p.m. There were many laymen sightseers, too, and if reports are to be believed, the final day of the exhibition, Sunday, was just as well attended.

POST-CONGRESS TOURS

For many of the visitors from overseas, Saturday or Sunday meant a return home, but about 200 to 300 participated in one or other of the three post-congress tours which occupied the period from September 9 to 15. Tours A and B first made a joint rendezvous at Frankfurt and stayed in the Frankfurt/Karlsruhe/Mannheim area until Wednesday, when party A went on to Constance, returning to Stuttgart on the Friday, while party B went earlier to the Stuttgart area. Tour C at the outset went from Düsseldorf to Munich and stayed in the Munich/Stuttgart/Mannheim area. For all the tours, whilst the menfolk were engaged on works visits, complementary visits to places of architectural or scenic interest were arranged for the ladies. During the programmes, also, there were several receptions by local branches of the German Foundrymen's Association (VDG).

Tour A

Monday, September 10

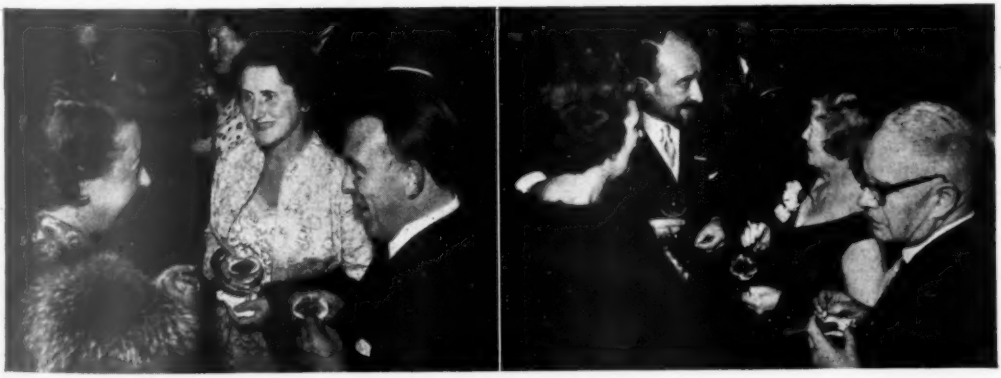
Tour A party reached Frankfurt at midday on Sunday, September 9, and after luncheon in the Kaiserkeller Restaurant, a sightseeing tour of the city had been arranged, although the writer personally used this opportunity for making up his notes. The whole of the next day was employed in works visits in the neighbourhood, the two works of Buderus'che Eisenwerke, one at Lollar and the other at Wetzlar being visited morning and afternoon by two separate parties which joined for luncheon with the firm and the Hessen branch of the VDG as hosts. The Lollar foundry has two automatic moulding plants for the production of heating radiator sections and also produces sectional heating boilers, while the Wetzlar plant operates de-Lavaud pipe-spinning and has also sections devoted to large general iron-castings manufacture, pipe components and "specials." Alternatively, in the afternoon, there was a visit to the non-ferrous and bell foundry of Geb. Rincker. Here, the actual casting of a bell was proceeded with on the arrival of the party. At the luncheon, the visitors were welcomed first by the firms' representatives and then on behalf of Dr. Grosser, president of the local VDG branch.

On return to Frankfurt (the writer's party arrived back at 8 p.m.), the evening was free.

Tuesday, September 11

On the Tuesday morning, party A continued by coach to Mannheim where they subdivided, the ladies for sightseeing and the menfolk for works visits—to Daimler-Benz AG, Heinrich Lanz AG, or G. M. Pfaff AG. The first two are iron foundries, one making car cylinder-blocks and -heads and the other farming machinery, while the third is an iron and steel foundry producing precision castings

FIG. 2.—*Informal groups at the reception of official delegates by the Lord Mayor of Düsseldorf at Benrath Castle. In the left-hand illustration, Mr. H. J. V. Williams, president of the Institute of British Foundrymen, and Mrs. Williams are reminiscing with Mrs. W. Riess, with Mr. G. Lambert (IBF secretary) and Mrs. Lambert in the background. In the second illustration, Dr. and Mrs. Schwietzke (left) are chatting with Dr. and Mrs. A. B. Everest.*



(using the Austenal lost-wax process) and aluminium pressure-die-castings. Here, also, the Croning shell-moulding process is in operation. (This visit provided most interesting comment for the visitors as to the economics of hot-blast cupola operation and shell moulding *versus* precision investment and die-casting processes. The writer on this day broke away from party A for a private visit to the foundry and workshops of Badische Maschinenfabrik at Karlsruhe-Durlach, makers of foundry plant (on the invitation of their British agents). Here, it was most interesting to see the firm's products put to work in their own foundry, making on a repetition basis, many sewing-machine parts but also individual castings up to 5 tons or more—a total of 300 tons per month. After luncheon as the guest of the firm, the main party was caught up with during its visit to Heidelberg Castle and the return to Mannheim that evening made with the party.

Reception at Bad Dürkheim

After but a scant half-hour in their new hotels at Mannheim, the party again boarded coaches for a reception and dinner in their honour at Bad Dürkheim, arranged by the Baden/Pfalz branch of the VDG in the Kurhaus and Kurpark Hotel. Delegates were welcomed by Dr. W. Wenz, president of the local branch, and Dr. A. B. Everest (at the conclusion of the dinner) returned thanks in English and French on behalf of the visitors, including mention of their appreciation also to the various works managements as well as Dr. and Mrs. Schwietzke and Mr. P. Schneider, the VDG secretary, who were also present at this function. High-class entertainment was provided for the rest of the evening, followed by dancing, the party returning to their hotels in Mannheim in the early hours of Wednesday morning.

Wednesday, September 12

Fortunately for the well-being of the party, whose stamina was beginning to be undermined by late nights, early risings, heavy meals and strenuous works visits, all of Wednesday was occupied by Tour A party in coach travelling to Constance. Unfortunately, however, the weather was not kind and for the trip through the Black Forest the lower roads had to be followed because of rain and mist.

Thursday, September 13

Three foundries in the Constance area received parties on the Thursday—Georg Fischer AG (malleable pipe fittings and automobile castings); Maschinenfabrik Fahr AG (malleable, grey, and spheroidal-graphite iron) and Escher Wyss GmbH (iron castings up to 45 tons for turbines, compressors and for the engineering industry). The writer went with the party to the Fischer foundry; it was welcomed on arrival by Dr. M. H. Schneebeli, speaking in three languages. One of the guides was Mr. C. Zehnder who was in this country at Bedford for several years before the war with the firm's subsidiary, Britannia Iron and Steel Works, Limited, of Bedford. Luncheon was by invitation of the company at the Central Hotel, Singen.

Final Social Engagement

Following the return to Constance, that evening there was the final social engagement of the tour. It consisted of a reception, dinner and entertainment organized by the Southern branch of the VDG, in the historic Insel Hotel, which was once a monastery and still possesses its cloisters. Here, the vice-president of the local branch, Mr. Fr. Nielsen, deputized for the president, Mr. Debers, in welcoming their guests (in three languages) on behalf of the VDG, copper-base, iron and steel founders. After dinner, Dr. Schwietzke bid the delegates "God speed," after first thanking the local groups of the VDG for their help in the organization. Finally, he expressed a wish that all would reassemble in Stockholm next August. Afterwards, Mr. Paul Blanchard, president of the Paris region founders, made grateful reply.

Friday, September 14

The final day of the tour, September 14, was spent in the return journey to Stuttgart (from which place members of tours A and B disbanded), the menfolk visiting *en route* the non-ferrous, shell and investment foundries, wire-rod mills, bearing-metal foundries and machine shops of Fürstlich Hohenzollernsche Hüttenverwaltung, followed by luncheon in the dining saloon of the host works. Here again, it was interesting to compare the various foundry processes carried on in such close proximity, though shell and investment techniques were of comparatively recent adoption. Before reaching Stuttgart, the ladies' party was joined for a visit to Hohenzollern Castle.

Other Tours

The list of works visited by tours B and C, each of which had its contingent of UK visitors, included the following (in addition to works already mentioned): Saarländisches Stahlwerk, Dingler, Karcher & Cie, GmbH of Worms (steel foundry); Halberg Maschinenbau und Giesserei GmbH of Ludwigshafen (iron foundry); W.u.W. Schenk KG, Leichtgusswerke of Maulbronn (light metal foundry); Metallwerk Karl Leibfried of Böblingen (light metal and non-ferrous foundry); J. M. Voith GmbH, Maschinenfabrik, Heidenheim/Brenz (iron foundry); A. Stotz AG, Stuttgart (grey iron and malleable foundry); Robert Bosch GmbH, Stuttgart (iron and aluminium foundry); Danner & Gröschel of Nuremberg (pressure-die-castings); Aluminiumwerke Nürnberg (aluminium, sand, die- and pressure-die-castings); Bayeische Motorenwerke AG of Munich (light-metal, sand, die- and pressure-die-castings); Maschinenfabrik Esslingen (iron foundry); M. Streicher, iron and steel founders, Bad Cannstatt.

For these delegates also, several official receptions were organized—members of tour B, in addition to the joint reception with tour A at Bad Dürkheim, were entertained by the Southern branch of the VDG at Bad Cannstatt on September 14, and tour C members at Munich by the Bavarian branch on September 11 and at Bad Dürkheim by the Baden/Pfalz branch on September 14. This party concluded its tour at Mannheim.

Receivers, Tapping Systems and Slag Disposal

*Report of Sub-committee T.S.44 of the IBF Technical Council**

Initially, an authoritative review is made of no fewer than five major tapping systems applied to the cupola, consideration of the continuous type itself being related to six different methods in use. Other comments in this section deal with slagging systems, refractories, advantages and disadvantages, and metal composition. In the next section, receivers, both fixed and portable, heated and non-heated, are considered. Experimental data are recorded as to relative efficiencies and effect on metal composition and structure. Fuels and fuel consumption, refractories and control methods, are also surveyed. The final section, on slag disposal, deals with containers and granulation systems.

In the report of sub-committee T.S.36 to the Technical Council of the Institute of British Foundrymen, a paragraph on "Cupola Hot Metal Receivers and Tapping Systems" stated that: "Sufficient information is now available within the industry to make a critical survey of the value and effect of receivers and forehearths, and to formulate recommendations for their use. The relative merits of various types of units could be considered, such as unfired tea-pot types and those heated by gas, oil or electricity. Factors requiring consideration would be design, capacities in relation to given cupola-melting rates, refractory-lining practice and fuel consumption.

"Continuous tapping systems are frequently used in conjunction with receiving units, and a number of types are in current use. It is suggested, therefore, that a review of these methods be incorporated in the committee work on forehearths with reference to refractory practice and dimensions for satisfactory slag separation. Slag-handling and disposal methods could usefully be included in the work."

Accordingly, the Technical Council formed sub-committee T.S.44 in 1952 with the following terms of reference:—

> "To review the value and effect of receivers, including tapping systems and slag-handling and disposal methods."

Nomenclature

Certain terms having varying usage are given here with the meanings adopted in this Report:—

Receiver: A container for metal, and possibly for slag also, used to hold molten metal before filling the pouring or distributing ladles. Solid additions may also be melted in the receiver, particularly in an electric furnace used as a receiver.

Forehearth: A fixed receiver, joined directly or by a short spout to the cupola.

I—TAPPING SYSTEMS

The increasing application of foundry mechanization has encouraged greater consideration of techniques for tapping, storing and distributing molten metal from the cupola. In many production foundries, the former method of intermittent botting and tapping the metal into ladles, with periodic opening of the slag hole at the rear of the cupola, has now been superseded by various systems of continuous tapping.

(1) Walbro' Cupola

A simple system known as the Walbro' cupola[1] (Fig. 1) comprises an open taphole in the centre of the cupola bottom, through which metal and slag flow continuously into a tea-pot ladle which acts as a receiver, the slag flowing over the back of the ladle when it is tilted backwards from time to time. The joints are sealed with ganister, and the bottom rammed with sand to a semi-circular profile. The system is used regularly in a few foundries, and for melting rates of 1 to 2½ tons per hour the taphole diameter increases by only ¼ or 1 in. during nine hours' blowing. The blast flame extends about

*Submitted for consideration at the annual conference of the Institute of British Foundrymen in Cardiff last June.

Constitution of Sub-committee T.S.44

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Mr. C. S. Johnson served as chairman of the sub-committee from its inception in February, 1952, to June, 1952, when transfer to new activities within his company made it necessary for him to resign; the sub-committee pays tribute to his work, which provided a sound basis for its subsequent activities. In addition, the sub-committee expresses appreciation of the valuable contributions to the work made by Mr. E. R. Dunning who served on the sub-committee from February, 1952, to September, 1954.

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12 in. below the bottom of the nozzle. Improved metal temperatures and simplicity are claimed for this system.

(2) Syphon Brick

Fig. 2 gives a diagrammatical representation of a syphon-brick[2] installation with which intermittent back-slagging is practised, but botting and tapping are avoided. Provided the height, H, is at least 1 in. for every 7 in. w.g. blast pressure, sufficient metal to seal the opening into the syphon brick is maintained in the well. Metal is tapped by opening the blast valve, and closing it again after each ladle

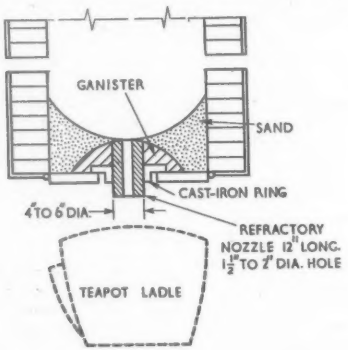


FIG. 1.—*Section through the "Walbro" cupola.*

is filled; thus metal is flowing only while the blast is on.

This system is advocated as a simple, reliable and inexpensive method for providing continuous availability of metal. Disadvantages which arise from intermittent blowing are variations in composition and loss of both through-put and temperature, the temperature loss being excessive if a ladle is large in relation to the melting rate. The method is in regular use, particularly for frequent filling of small shanks with phosphoric iron, without a receiver.

(3) Two-holed Breast Brick

A cupola may be modified for continuous tapping of iron merely by fitting a two-holed breast brick, the diameters of the tapholes being so chosen that one provides insufficient metal, while two holes provide an excess. By periodically opening and closing the upper hole according to the metal demand, a suitable supply of iron is maintained, the blast being correspondingly raised and lowered. This method has the obvious disadvantages of intermittent back slagging, and of requiring close attention in operation. Continuous rear-slagging may be added to a cupola with a two-holed breast brick by installing a slag spout as described in the following paragraph.

(4) Continuous Tapping and Continuous Rear-slagging

A system[3] used on cupolas of large diameter, with continuous tapping of iron and also of slag from separate outlets is shown in Fig. 3. It is preferable to locate the two spouts adjacent to one another, so that the sand bed may be sloped upwards from the front of the cupola, unless a large well capacity is required. However, in a foundry where site difficulties make front slagging impracticable, this system may be applicable, since the slag spout may be located anywhere around the cupola well, provided it is at the correct height.

With this system, segregation of the flowing metal and slag avoids any excessive erosion at the taphole, which may otherwise occur under arduous operating conditions. It should be noted that a substantial quantity of metal is maintained in the well, and drained at the end of the shift, either for pouring or pigging; a well capacity of two charges has been recommended to smooth out fluctuations in composition, but this involves a loss of metal temperature. By virtue of the mixing in the well, this system is suitable for use with a tilting spout without an external receiver (see section on receivers). Two spouts must be attended to and maintained.

(5) Continuous Front-slagging Systems

(a) Freier-Grunder Tapping Box.

The Freier-Grunder tapping box, an example of which is shown in Fig. 4, is believed to be the most favoured system of continuous tapping in this country, and a detailed practical operation sheet is given in an Appendix. The system requires very little attention from the operator, and has the advantage of utilizing a rammed, monolithic refractory, without joints which metal and slag may enter and enlarge. Strong and rigid steelwork is recommended, any open joints being sealed by welding. The tapping box is also known as the

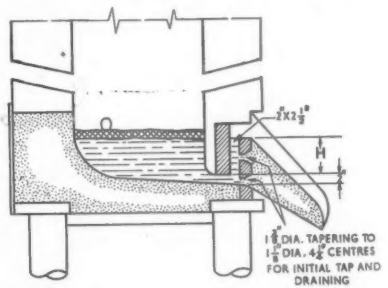


FIG. 2.—*Sketch of the syphon-brick system of cupola tapping.*

syphon box, and the front hole, EB, as the syphon hole.

Explanation.—When slag and metal are flowing freely with the blast on, the ferro-static pressure of the height of metal, BH (Fig. 4), equals the fluid pressure of the height above the taphole of the slag, F, in the well, together with the blast pressure on the surface of the slag, F (this blast pressure being less than the windbelt pressure). Hence, slag passes through the taphole and immediately ascends towards the slag notch A, which is higher than the

metal level B, and hence the fluid pressure of the slag C depresses the metal surface below it to a level D which is lower than B. Thereafter, metal and slag flow from their respective spouts at the rates at which they are descending into the well. The fluid pressure of the height of the metal, BH, must be greater than the blast pressure in the well to prevent blast escaping through the taphole at H. For example, if he blast pressure is 28-in. water gauge, the metal height, BH, should not be less than 4 in., and in practice is preferably more.

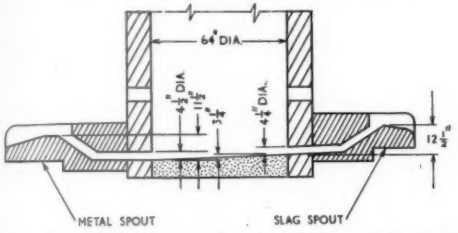


FIG. 3.—*Continuous, front-tapping and rear-slagging system for a cupola.*

(*b*) *Modified Tapping Box.*

A modified form of tapping box is shown in Fig. 5, providing greater refractory thickness at the front hole, better accessibility for the taphole, easier draining over the sloping bottom at the end of a shift, and more reliable slag-separation in the event of refractory erosion. These advantages are more important for multiple-shift operations, when repairs between shifts may be required without dropping the bottom doors of the cupola.

(*c*) *Continuous Front-slagging Spout.*

An example[4] of an American system utilizing the Freier-Grunder principle is shown in Fig. 6. This design is massive and rigid, and low maintenance costs are claimed. The use of bricks is usually considered a disadvantage because of joint erosion. The large dimensions, which are not essential for satisfactory operation, may be unsuitable in some layouts.

(*d*) *Separate Metal and Slag Tapholes.*

Continuous front-slagging systems may be modified by the addition of a slaghole above the usual taphole, with the levels so arranged that the metal flows only through the lower hole, and slag only through the upper one (Fig. 7). The main advantage of this modification is a reduction in taphole erosion, but the minimum well-depth must be a few inches higher, and the tapping box must be taller, to allow a sufficient height of slag to prevent blast escaping through the slaghole.

(*e*) *Tapping Box from British Patent Specification No.* 732,300.

The system illustrated in Fig. 8 is of Belgian origin, and the description was obtained through the British agents. The cupola and tapping-box shells are of one piece, the box is enclosed, and the slag is heated by a small oil-burner. The rammed neutral refractory is partly water-cooled, the water also providing direct slag granulation. Separate tapholes for iron and slag prevent slag erosion at the metal hole, particularly by a basic slag.

A slag depth of 15 to 20 in. is one of the main characteristics of the system, and permits control of metal composition by the composition and the depth of the slag in the well. Both tapholes are plugged until the iron hole is tapped through a hole in the front which is then botted. Major repairs are required after 4 to 8 weeks and slight repairs are made on the tapholes from the outside as required.

(*f*) *"Well-less" Cupola.*

Cupolas operating with a system of continuous front-slagging may be used "well-less"[5] by ramming a high sand-bed to within a few inches of the tuyeres leaving a channel for metal and slag to descend to the normal taphole (Fig. 9). A little additional care is required in preparing and operating such a cupola but, compared with normal front slagging, cold taps may be avoided, coke beds and preheating reduced, and generally higher metal temperatures attained. In foundries where high metal-temperatures are required regularly but are difficult to obtain consistently, the high sand-bed is advantageous.

To indicate the temperature gain by the use of a high sand-bed, a cupola of 60-in. i.d. in regular production with this modification was experimentally operated with a normal sand bed, other conditions remaining comparable. It should be noted that a low-grade coke was used throughout. With a

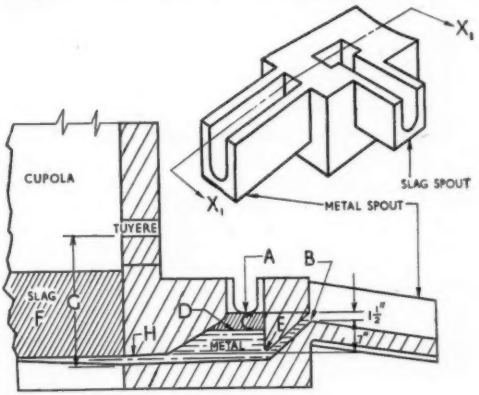


FIG. 4.—*Freier-Grunder cupola tapping-box.*

high sand-bed, the spout temperature rose from 1,425 to 1,490 deg. C. after 1½ hours. With the normal sand-bed, a first cupola metal temperature of 1,260 deg. C. was obtained. After the first half hour, the temperature remained about 35 deg. C. below the corresponding high-sand-bed temperature, and after one and a half hours had reached 1,455 deg. C. A similar but smaller lag occurred when restarting the cupola after stops.

Iron-oxide content of slags.—Although the same height of slag is maintained in the well as with a

normal sand-bed, the volume of slag present is merely a small proportion of the normal volume. After passing the tuyeres, slag reaches the taphole in a few minutes instead of in an hour or more, so that the high iron-oxide content at tuyere level is only partially reduced and the issuing slag contains 2 or 3 per cent. of iron oxides. Although some 2 per cent. higher than with a normal sand-bed and continuous tapping, this proportion is much lower than the varying 5 to 10 per cent. of iron oxide found in slags from intermittently-tapped cupolas. Unless a high basicity is required, a high sand-bed may be used in a basic cupola, but a reduction in desulphurization and sometimes in carburization ensues. (See later, under "carbon pick-up".)

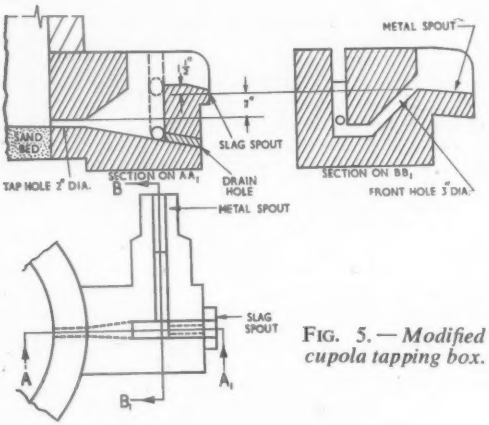


FIG. 5.—*Modified cupola tapping box.*

Recommended Dimensions for Front Slagging

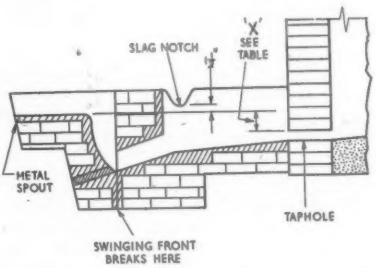
For satisfactory slag separation, the slag notch A (Fig. 4) should be about 1½ in. above the metal spout level B; this is sufficient to prevent a normal flow of iron from reaching the slag notch, A, and insufficient for the layer of slag C in the box to depress the metal level in the box D to the lower end of the front hole E, and so permit slag to escape with the metal.

The metal spout level, B, shown in Fig. 4, is satisfactory over a range of windbelt pressures from 5 to 45 in. water gauge, and it should not be necessary to vary the metal level, B, with the blast pressure. When such an alteration is required, it is readily effected by changing both metal and slag spout levels B, and A, by equal amounts. If the slag F in the well approaches tuyere level, it may be solidified by the cold blast and lead to bridging at the tuyeres; a minimum well-depth G, of 20 or 24 in. is therefore recommended. Where this well-depth cannot be obtained, lower metal and slag levels B and A may be operated, provided the blast pressure is not high enough to force air through the taphole H. A suitable metal level B, measured from the top, H, of the taphole to the metal-spout level B, is one seventh of the windbelt pressure in inches water gauge, plus half an inch; it will be noted that this formula is derived from the relative density of molten iron, and does not provide for the variable pressure drop between the windbelt and the interior of the well. The disadvantage of operating with low levels for A and B is the risk of failure due to variations in operation or dimensions or to erosion.

Automatic compensation for variation in blast pressure in the well has been proposed[7] by making the metal chute very narrow with vertical sides, additional blast producing faster melting and causing an appreciable rise in the metal level and hence balancing the increased blast pressure without alteration to the quantity of slag maintained in the well. Although several objections arise, this device does provide a partial solution to the problem of varying slag-level in the cupola well produced by varying blast-pressure, and is particularly applicable where tuyere height above the taphole would otherwise be insufficient.

A long distance between the taphole and slag separating wall is sometimes advocated for improved slag separation. Owing to the substantial difference between the densities of iron and slag, separation occurs in the well, and metal and slag flow through the taphole in separate layers, the slag then flowing up the slope of the tapered outlet and up to the slag overflow. Provided the levels are correct, slag does not approach the bottom of the front hole, however small the dimensions of the box.

A drain hole is often provided, and may be conveniently situated at the front of the box or in the well away from the box, the taphole and the refractory bottom of the box sloping gently to the drain hole. If a drain hole is not used, the bottom and taphole should slope gently so that metal and



Windbox pressure-oz. per sq. in. ..	4	8	12	16	20	24	28	32
Windbox pressure-inches of water ..	6.9	13.9	20.8	27.7	34.7	41.6	48.5	55.4
Vertical distance X, inches ..	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5

FIG. 6.—*Continuous front-slagging cupola spout.*

slag will drain from the box and front hole into the cupola well, after the bottom is dropped. It should be noted that after the furnace is blown down, the quantity of residual metal is very small, since the metal in the taphole is insufficient to fill it, the slope of the sand bed reduces the quantity of metal in the well, and the tapping box is partly filled with slag.

Refractories

(*i*) *Acid Cupolas.*

Some users report satisfactory life using a rammed ganister of a high fusion-point (Cone 31-32), but under more arduous conditions of high tonnages, high coke-ratios, high limestone and fluorspar charges, the addition of plumbago or other suitable carbonaceous material to that ganister, as described in the Appendix, is strongly recommended. Although plumbago is an expensive material, hundreds of tons of iron may be passed through the box before a major repair is required, reducing the cost of the tapping system to a few pence per ton. Eroded refractory may be repaired between runs by chipping away the smooth surface and ramming either a patch or a substantial part of a tapping box with the original mixture.

(*ii*) *Basic Cupolas.*

The monolithic mixture described in the Appendix is suitable for basic cupolas using slags of moderate basicity. For slags of extreme basicity, a proprietary carbonaceous ramming material is recommended, which must be quenched with water immediately the cupola is dropped, to prevent ashing. American refractories for this application have been described elsewhere[6].

Application and Advantages of Continuous Tapping

The requirements of a large, highly-mechanized, flow-production foundry call for a smooth controlled supply of metal of specified composition at a steady temperature; this demand has led to continuous tapping into a receiver. As the throughput, hours of operation of the cupola and the mechanization of the foundry diminish, continuous tapping becomes less advantageous, until in the jobbing foundry, there is little application for it. A large, heated receiver can be used to accumulate metal from a small cupola to pour a heavy casting, but at a higher fuel cost.

On changing to continuous tapping as in methods (5) (*a*), (*b*) and (*c*), varying quantities of slag and metal in the well are replaced by a constant large quantity of slag, and a very small constant quantity of iron. The wide variation in carbon pick-up, sometimes observed, may be avoided, since the molten metal has only a brief but uniform period of contact with the coke before reaching the taphole. The slag, however, remains in contact with the coke in the well for an hour or so, while descending to the taphole level before escaping. During this time, the iron oxide content is reduced to well below 1 per cent.

In conjunction with a suitable receiver, melting may be controlled at a steady rate until production ceases, thereby fulfilling one of the essential conditions of correct cupola operation in order to obtain uniformity in metal composition and temperature. The operator's judgment has less influence on cupola operation, and technical control is facilitated thereby. Irregular blast-loss through the open slag notch is eliminated.

The majority of the cupola tender's difficulties vanish when his cupola is converted to continuous front-slagging; the occasional failure to bot the taphole in time, the hard taphole, the leaking taphole, the slag in the tuyeres and the slag in the ladle are all eliminated. The salg hole does not enlarge or block, and during the run the tender mainly clears the tuyeres and watches the metal and slag running smoothly down their respective spouts. Operations which may be hot and arduous are eliminated, and the tender has more of a watching brief, which leaves some opportunity for

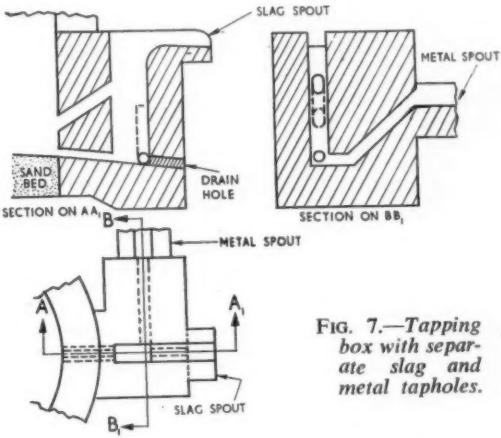


FIG. 7.—*Tapping box with separate slag and metal tapholes.*

alternative work. Slag is no longer blown about to festoon the area behind the cupola; it may be conveniently granulated or collected in suitable ladles. Occasionally, the eight inches or so of extra spout-height, which is available with continuous tapping, may be of practical advantage.

For metal which is subsequently desulphurized, the effective slag-separation provided by a continuous-slagging spout, prevents slag interference in the treatment. In a basic cupola, a low-iron-oxide content in the slag is essential for the production of a low-sulphur iron, and is readily achieved by continuous front-slagging. As the slag passes very slowly downwards through the well, reduction of iron oxides in the slag by the coke in the well proceeds steadily. A large and constant depth of slag is readily maintained in the well and promotes effective desulphurization.

Disadvantages of Continuous Tapping

Installation and maintenance cost in labour and materials for continuous tapping are small provided a moderate or large tonnage is melted, but may be

disproportionately high for a low output. Owing to the slow flow of metal, a receiver is usually required with a continuously-tapping cupola, involving further costs in installation, operation and maintenance. Supervisors and operators must become familiar with the system, though little difficulty should be encountered. It should be noted that the sub-committee is not aware of any foundry which has reverted to intermittent tapping for work suitable for continuous tapping.

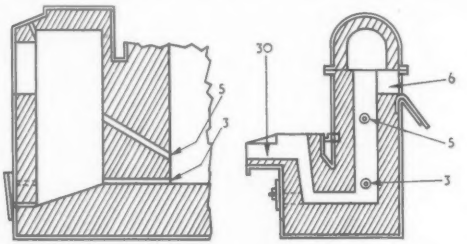


FIG. 8.—*Tapping box from British Patent specification No. 732,200 (reproduced by permission of the Controller of HM Stationery Office).*

Key: (3) Metal taphole; (5) slag taphole; (30) metal spout; (6) slag spout.

Effect on Metal Temperatures

Although tapping temperatures are higher with continuous front-slagging (particularly with a "Well-less" system), little advantage is gained since the rate of flow is low compared with intermittent tapping. A substantial loss of temperature, which is greater at low melting-rates, ensues while metal is accumulated in ladle or receiver, and methods for neutralizing this loss are expensive (see "receivers" later).

Minimum Melting Rate

It is considered that for melting rates of less than three tons per hour, the thin stream of metal suffers an excessive temperature-loss unless special precautions are taken. To minimize temperature losses, the chute for the metal should be as short as possible, it should be lined to provide a narrow metal-stream, and it should be completely covered and sealed to prevent convection of air. At the end, the opening for the metal outlet should be a little larger than the metal stream. Similarly, the slow-moving slag may encrust and block the slag overflow, but the addition of up to 1 per cent. of lump fluorspar to the charge will assist to maintain slag fluidity, and the tapping box and slag chute should be covered and sealed to avoid convection. A large opening must remain for the slag overflow, and charcoal grains should be sprinkled to cover the slag, and if necessary, a gas burner used to maintain a temperature at which the slag cannot solidify. It should be noted that continuous front-slagging with an output of one ton per hour has been reported[8].

Effect on Metal Composition

It is often considered that intermittent tapping smooths the variations in metal composition as melting proceeds, by virtue of the accumulation of metal before tapping. With continuous tapping, this mixing usually takes place in a receiver, and is often valuable or even essential in practice. Under conditions more nearly approaching the ideal—with uniform materials, accurate weighing and correct operation—metal samples taken in quick succession from the spout of a continuously tapped cupola show little variation in composition, though a very small quantity of molten metal is maintained in the well and tapping system. (Table I.)

TABLE I.—*Uniformity of Composition with Continuous Tapping.*

NOTE: The need for a reservoir of metal to smooth composition fluctuations is often exaggerated. The table shows cupola-spout analyses at one-minute intervals for half an hour of uniform operation, the only reservoir being the tapping box, holding merely a few pounds of metal.

Cupola Data: Shell diameter 54 in.; lining 9 in. ganister; water cooling, nil; tuyeres (6) 9 in. dia.; high sand-bed (Fig. 9); original coke bed 45 in.; blast temp. 480 deg. C.; blast 3,500 cub. ft. per min.; pressure 26 in. water gauge; melting rate 5 tons per hr. *Charge Constituents* (per cent.): pig-iron (4.4 Si) 22.4; pig-iron (2.6 Si) 25.6; steel scrap 20.0; b/scrap 32.0; FeMn (78 per cent.) 0.24; limestone 3.2; fluorspar 0.4; coke 13.5.

Sample.	Analysis.					Temperature, deg. C.
	T.C.	Si.	Mn.	S.	P.	
1	3.41	2.06	0.69	0.112	0.142	—
2	3.45	2.06	—	—	—	—
3	3.45	2.11	—	—	—	—
4	3.45	2.11	—	—	—	—
5	3.47	2.11	—	—	—	—
6	3.45	2.06	—	—	—	—
7	3.43	2.02	—	—	—	1,500
8	3.45	2.02	—	—	—	—
9	3.39	2.02	—	—	—	—
10	3.37	2.06	—	—	—	—
11	3.35	2.16	—	—	—	1,500
12	3.41	2.16	—	—	—	—
13	3.45	2.16	—	—	—	—
14	3.39	2.21	—	—	—	—
15	3.33	2.21	0.66	0.118	0.140	1,490
16	3.35	2.26	—	—	—	—
17	3.43	2.21	—	—	—	—
18	3.47	2.30	—	—	—	—
19	3.45	2.26	—	—	—	1,490
20	3.49	2.30	—	—	—	—
21	3.43	2.21	—	—	—	—
22	3.49	2.16	—	—	—	1,510
23	3.35	2.06	—	—	—	—
24	3.47	2.02	—	—	—	—
25	3.37	2.06	—	—	—	1,510
26	3.47	2.02	—	—	—	—
27	3.43	2.02	—	—	—	—
28	3.41	2.02	—	—	—	1,510
29	3.47	1.97	0.66	0.108	0.138	—

If required, continuous tapping by systems 4, 5(d) or 5(e) will provide more uniform mixing in the well than intermittent tapping. Similarly, a uniform bath of metal may be maintained in the well using systems 5(a), 5(b) or 5(c) by enlarging the taphole and raising the metal and slag levels. By avoiding leaving metal in the well in contact with

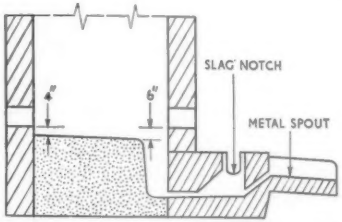


FIG. 9.—*Well-less cupola (high sand-bed).*

coke for irregular periods, continuous tapping may provide more uniform carbon pick-up, particularly with low-carbon charges or in other circumstances which favour carbon pick-up. There appears to be little evidence upon differences in average composition of metal tapped intermittently as against continuously, and it may be assumed that such differences are generally small.

Carbon Pick-up

No accurate comparisons of carbon pick-up with intermittent and continuous tapping are available to the sub-committee, but foundries changing from one system to the other have not reported noticeable differences in this respect[9]. Similarly, foundries using the Freier-Grunder tapping system and subsequently adding a high sand-bed, system 5 (f), thereby eliminating most of the coke from the well, have not reported changes in carbon pick-up. On the other hand, in a continuously-tapped, acid cupola, melting a 70 per cent. steel charge for the manufacture of "refined iron," an additional carbon pick-up of 0.1 per cent. was obtained from an increase of a foot in well depth. Again, in a basic cupola, melting ordinary grey iron, the addition of a high sand-bed produced no great change in carbon pick-up. Yet in a basic cupola operating with a charged carbon of 1.4 per cent. and tapping at 2.7 per cent., the carbon pick-up was reduced by 0.5 per cent. to tap at 2.2 per cent. by adding a high sand-bed.

Thus it appears that though the well may have little effect on carbon pick-up with ordinary grey-iron charges, low-carbon charges may gain carbon in the well. High-grade, low-ash foundry coke will promote carburization in the well, and it is to be expected that any differences in pick-up will be more marked than with low-grade coke.

(To be continued)

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New Large Blast Furnaces for Russia

The pig-iron target of the USSR under the sixth five-year plan is 53,000,000 tons by 1960. Some 13,000,000 tons of this are expected to come from proposed new capacity. To accompany this new five-year plan, a standard 2,000-cub.-m. blast furnace has been designed, which will be the largest in the world. According to the February issue of the Russian journal *Stal*, the hearth diameter will be 9.9 m. (32½ ft.). Some 5,000 tons of pig-iron per day are expected from the furnace, this being based on a utilization coefficient of useful capacity of 0.40. No furnace in the USSR has yet reached such a high coefficient of efficiency, the highest being in the range of 0.55 to 0.60. Modern techniques to be incorporated in the new furnace include constant-humidity blast, high top pressure, and complete automation, especially of the methods of charging. With a fully prepared charge, it is hoped that daily coke usage per cubic metre of useful capacity will be no more than 1.5 tons.

Other dimensions of the new furnace, according to *Stal* are:—Bosh parallel dia., 36 ft.; throat dia., 24 ft.; and large bell dia. (see Fig. 1), 17½ ft. The overall height will be 105 ft.; useful height, 92 ft.; depth of hearth, 11.2 ft.; depth of bosh, 10.5 ft.; depth of bosh parallel, 6.5 ft.; height of stack, 57 ft.; height of throat, 8.2 ft.; height of slag notch, 5-5.5 ft.; height of air tuyeres, 9.5 ft. The bosh angle will be 81 deg. 7 min. and the stack angle 84 deg. 9 min. There will be 24 tuyeres.

The new furnaces are to be built during the current five-year plan at some of the large and expanding plants, the following being mentioned:—Azov-stal, Zhdanov (Ukraine); Krivorozh-stal, Krivoi Rog (Ukraine); Novo-Tagil Works, Nizhniy Tagil (Urals); Bakal Metallurgical Works, Chelyabinsk (Urals), and Novo-Lipetsk Works, Lipetsk (Central Russia).

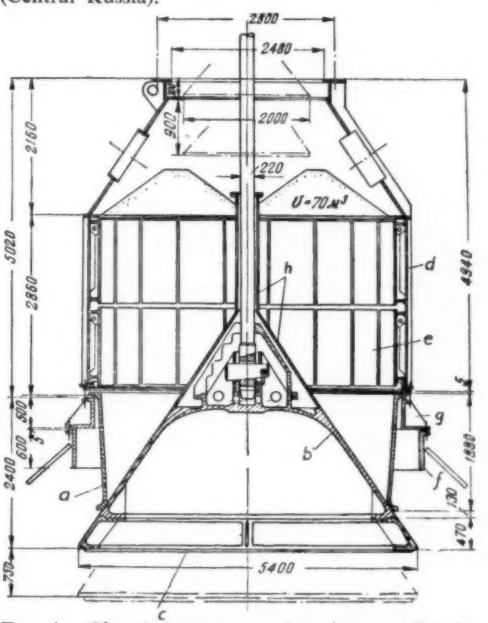

FIG. 1.—*Charging apparatus for the new Russian blast furnace.*

(a) All-cast hopper; (b) all-cast portion of the big bell; (c) lower part of the big bell (in two halves); (d) gas-tight casing; (e) protective plating; (f) throat flange; (g) spacing ring, and (h) protective casing.

Porcelain Enamel on Aluminium

*Review of the American Scene**

In recent years, a new combination has appeared in the form of aluminium and porcelain enamel. In certain areas, the advantages of this combination become obvious. The lightness, strength and corrosion resistance of aluminium are retained. The application of vitreous enamels enhances these properties by adding colour, resistance to abrasion or scratching, and ability to withstand the corrosive attack of certain compounds and chemicals that attack bare aluminium. Rigidity and resistance to flexing are greatly enhanced without sacrifice of weight. Unusually wide variations in colour and surface textures through the use of vitreous enamel suggest further uses for porcelain enamelled aluminium.

These advantages, in certain applications, can lead to economies in construction. In particular, a standard thickness coating of vitreous enamel increases the rigidity of aluminium sheet by as much as 60 per cent. This means that lighter-gauge metal can be used with subsequent weight savings. Any metal thickness, from foil to plate, can be coated successfully.

Coating Process

The process of coating aluminium with enamel is not difficult when conducted under close control with metal that is properly cleaned and free from grease. The metal is first immersed in a bath composed of caustic and chromate compounds at temperature of approximately 65 deg. C. for five minutes. Following immersion, the aluminium is washed very thoroughly to remove all traces of the chromate solution, and dried. The metal is then pre-fired to render the chromate film insoluble and ready for enamel application.

The enamel application itself follows the normal procedure by which fine frits are sprayed on with fine-tip guns. The amount of enamel usually applied per coat is less than is applied in sheet steel enamelling. Two coats give a thickness of between 0·003 and 0·005 in., depending upon the colour and surface required. The ware is fired at 520 to 537 deg. C. for a minimum of five minutes for thin ware, and correspondingly longer times for heavier sections.

Highly Durable Coating

There are virtually no limitations to the range of light-fast colours available for the process, extending opportunities for this material in a competitive market. The Porcelain Enamel Institute gives the material a high oxide-durability rating. In standard impact tests, enamelled samples average five impacts before any loss in coating can be detected. No sharp edges were evident and no progressive spalling created through surface damage. Panels heated to 537 deg. C. have been plunged into cold water with no cracking or flaking of the enamel coating. Surfaces exposed to instantaneous temperature of 1,315 deg. C. show no noticeable damage.

One of the advantages that the material possesses in a competitive market is the ease with which it can be fabricated. Enamelled aluminium can be sheared, sawed, drilled or punched with little or no exposure of the metal and no spalling. It can be welded on the reverse side without discoloration or damage to the coating. The enamel itself can be applied over welds. The material has a voltage breakdown rating of 500 v. per mil† thickness, making it an ideal insulating and shielding material.

Applications

Although only recently on the market, this material is already finding acceptance in a wide range of areas. These include architectural siding, store fronts, roofing, wall tile and ceiling panels. Signs and labels featuring colour, lightness and durability are also proving to be markets for the material, as are electrical shieldings. It is in the field of coloured finishes that porcelain-enamelled aluminium offers the greatest advantages. A wide range of light-fast colours is available in almost any degree of surface reflectivity, from very dull matte to an extremely high gloss. Architects have been quick to take advantage of these coloured finishes.

In the appliance field, enamelled aluminium functions effectively on stoves, refrigerators, washers and driers, with savings in fabrication and shipping costs. In the realm of furniture, it is used for hardware and trim, dials and instruments, lighting fixtures, transport equipment and sanitary ware.

The Porcelain Enamel Institute (of the USA) estimates that the demand for vitreous enamel frits for use on aluminium will reach 100,000 tons annually by 1970. The significance of this huge new market can be assessed when it is remembered that an average vitreous coating for aluminium weighs only 10 grams per mil thickness per sq. ft. A typical three-mil coating increases the total thickness of the sheet by less than 6 per cent. and the weight by less than 10 per cent. This bright future is foreseen because the process enhances the existing properties of two already important base materials and results in a combination which adds new advantages without any deterioration of existing properties.

* Abstract of an article entitled "Porcelain Enamel Finishes," reprinted from *Aluminium News*, the House Organ of Aluminium, Limited.

† One mil = 0.001 in.—Editor.

Turbo-generators for Canadian Power Stations

Turbo-generators worth £1,308,000 are to be supplied to Canada by C. A. Parsons & Company, Limited, Newcastle-upon-Tyne. The Hydro Electric Power Commission of Ontario, Canada, has ordered from the firm two more 200 mw turbo-generators which are to be installed in the Richard L. Hearn generating station, Toronto. This will bring the station's output to 1,000,000 kw. Already in service in the station are four 100,000 kw. units; a fifth of 200,000 kw. capacity will be installed in October, 1958, while the sixth and seventh units now ordered will be added in 1959 and 1960 respectively.

An order for two 66 mw. turbo-generators with surface condensing plant has also been received by Parsons for the new Manitoba Hydro-Electric Board, Winnipeg, Canada. The turbines will operate with steam at a pressure of 850 lb. per in.^{2} gauge at the stop valve and a temperature of 900 deg. F. The generators will be of the hydrogen-cooled type generating at 13,800 volts. The new power station, one of the largest in western Canada, will be situated about 24 miles north of Winnipeg on a site opposite Selkirk, on the Red River.

THE JULY MEETING of the Australian branch, held in the Melbourne Technical College, was devoted to the reading of a paper by Mr. J. Anderson, A.R.M.T.C., on the CO_2 Process. The Author drew on his experience gained from overseas visits and from practical work in Australia. Films were used to illustrate the lecture.

Research at the Sheffield Laboratories of BISRA

The Sheffield laboratories of the British Iron and Steel Research Association were officially opened in 1953. An account is given below of some of the progress made during the last three years in matters having some connection with the founding industry. The laboratories were visited by members and guests of the British Association at the end of August.

Research at the Sheffield laboratories of the British Iron and Steel Research Association is concerned mainly with steelmaking, metalworking and ferrous metallurgy. Sheffield is also the base for a "steel users" section which deals with technical enquiries and investigations on the uses of iron and steel. In the same building and sharing the Association's general services such as library and information, workshop, maintenance, etc., are three autonomous co-operative research organizations for the cutlery, file and coil-spring trades.

During the meeting in Sheffield of the British Association for the Advancement of Science, the Sheffield laboratories were visited on August 31 and September 3 by members. Following these visits, "open days" for BISRA members were held on September 6 and 7, when staff of iron and steel firms and others interested had the opportunity of seeing the work in progress and some of the results obtained.

Steelmaking

The steelmaking division takes up the story of steel with the hot metal when it leaves the blast furnace and goes on until it has been turned into a product suitable for working by cogging mill, rolling mill or forge. The researches concern, therefore, the operation of open-hearth furnaces and electric-arc furnaces, the chemistry of steelmaking in each, and problems of ingots and ingot moulds.

Almost as though the division were indulging in its own celebration of the Bessemer Centenary, this year sees renewed interest in pneumatic methods for pre-refining hot metal and for making steel, and an intensification of the work on continuous casting, on which Bessemer held the first patents.

The open-hearth furnace research section has formed a small team, expert in handling the combustion problems of open-hearth furnaces, which produce about 90 per cent. of this country's steel. As more furnaces are fired with liquid fuels sometimes supplemented with coke-oven gas, greater emphasis has been placed on burner design, and research by BISRA has shown what are the essentials of a good burner. A team is applying this knowledge at a number of works. It has also played a large part in developing a suction pyrometer and a technique for measuring air temperatures which now provides almost trouble-free continuous automatic recording of the temperature of the combustion air in the air uptakes. The team has now begun research into regenerators and has already suggested a new design.

The control of sulphur is an ever-present problem and is one which will become more difficult to solve as more furnaces are fired with liquid fuels containing high sulphur. An investigation of several slag-control methods in use for desulphurization in the open hearth shows that the degree of control leaves much to be desired. Sulphur pick-up by the charge during the melting down period increases as the sulphur input in the fuel increases, and it is proposed to investigate this on a 1/12 scale model of an open-hearth furnace operated at high temperatures. At the same time this model will be used to study the heat-transfer mechanism from the flame to a calorimeter hearth.

The melting shop at the Association's Sheffield laboratories houses a 10-cwt. basic electric-arc furnace which can operate at power inputs which are high compared with those of most industrial arc furnaces. This arrangement has made it possible to study the effects of different power inputs on the consumption of electricity and electrodes, on melting rate, and on roof wear. Heat balances have been determined at two input rates and the effects of changing the diameter of the electrodes and the height of the furnace have been studied.

It has been shown that at least half the electrode consumption arises from burning away of the surface of the graphite, and means of reducing the amount lost in this way are being sought. Coatings have been tried unsuccessfully, but impregnating the porous graphite with a suitable refractory material might reduce the loss.

Interest in the electrical side of the furnace has grown since a complete investigation of the electrical characteristics of the 10-cwt. furnace was made, and BISRA has promoted the formation of an electrical engineering group. This group is also investigating the use, as a means of slag control, of the rectifying action of the furnace which can make a direct current flow between the electrodes and the hearth *via* the slag and metal.

The temperature of open-hearth furnace roofs has been measured continuously for many years and the fuel input has in many cases been automatically controlled to prevent the temperature from exceeding a safe limit. No such routine measurements are, however, made on electric-arc furnaces. Measurements of temperature were made on the experimental furnace for the study of roof wear and the possibility of providing a continuous record during production is being investigated on the small furnace and on production units at members' works.

Knowledge of the physico-chemical relationships between slag and metal in the electric-arc furnace is not yet complete, as the slags are very complex. A special programme of research has been undertaken by the chemistry department to investigate the thermodynamics of slags and reactions in the

FIG. 1.—*Unit for vibrating a mould while casting.*

electric process. Further work on slag control for sulphur and phosphorus removal has been postponed until these data are available.

Feeder Heads

A study of feeder heads for ingots has had some useful results. Refractory feeder heads are used on most killed steel ingots in order to slow down freezing at the top of the ingot and thus to concentrate piping and segregation into a small part of the ingot. With conventional practice, however, it is still necessary to discard 10 to 15 per cent. of the ingot. For good feeding, it is necessary to minimize heat losses from the steel in the feeder head; heat balances on ingot heads have shown that a high proportion of the heat lost by the steel is absorbed by the refractory. Hence refractories of low heat capacity are the most efficient, especially since low heat capacity is usually allied to low thermal conductivity. High-temperature insulating brick is effective when used for small ingots, and a special double-walled headbox of low heat capacity has been designed to make use of the excellent thermal properties of vermiculite. It is being tested in a steelworks on larger ingots. The value of exothermic sleeves and top additions has been demonstrated but, as they are expensive, work on cheaper composite sleeves or tiles is being carried out in conjunction with a manufacturer.

Ever since steel began to be made in large quantities, men have dreamed of casting the molten material continuously into sizes that would avoid the need for soaking and cogging on the way to the finished product. In recent years, processes for continuous casting have developed rapidly and at least four plants are working in this country, two of which use a method patented by BISRA.

The plant at BISRA's Sheffield laboratories casts 4-in. sq. ingots, up to 20 ft. long, at about 7 tons per hour (5 ft. per min.), using 10-cwt. charges from the arc furnace. The present programme of investigation includes the effects on quality of speed and temperature of casting and cooling rate. The plant is fully instrumented to obtain as much information as possible from each cast. Samples of continuously cast steel to their own specifications are also being produced for member firms who are interested in the process for their own production needs.

Whereas some works on the Continent enjoy the advantage of large-scale "tonnage" oxygen plants, it is only recently that this much cheaper grade of oxygen has begun to be available in this country. A rapid change is now taking place and almost every large steel-making area in this country will soon have a piped oxygen service. Research on the use of oxygen, both in steelmaking and for pre-refining blast-furnace iron, is increasing. It has been shown that the removal of phosphorus can be easily controlled while holding a high proportion of the carbon in the metal, and the use of metal pre-refined in this way leads to the greater output from open-hearth furnaces. BISRA has designed a water-cooled oxygen gun for use in the top blowing process for making a finished steel from hot pig-iron with a medium amount of phosphorus.

FIG. 2.—*Vacuum-fusion gas-analysis apparatus with all-metal evacuation system, developed by BISRA in collaboration with W. Edwards (Vacuum) Limited.*

and works experiments have been successful on 3 tons in a side-blown converter adapted for the purpose.

Vibration during Casting

The quality of high-speed tool steels is reduced by the formation of a coarse cellular network of carbide during solidification. This structure causes difficulties in hot working and tends to persist in the final wrought material; it encourages cracks to form during heat-treatment, and detracts from the properties of finished tools. Many attempts have been made in the past to modify the cast structure, but only minor improvements have been achieved. Several different methods have been tried in the hope of reducing the size of the primary dendrites. An attempt was made to "inoculate" the melt with some substance which would encourage crystallization at many centres. Many substances were considered and a few have been tested both in the laboratory and in works with negative effects. The effects of vibration and stirring during freezing are now being studied (Fig. 1). Industrial experiments have already shown that certain vibrations have a markedly bad effect on the ingot structure of high-speed steel, but perhaps different conditions of vibration might improve it.

Engineers are becoming more and more exacting in their requirements for mild steels used in large, welded structures (ships, oil tanks, etc.), and increasing importance is being given to the production, in large quantities, of mild steel having a high resistance to brittle fracture.

The analytical section provides a service to the whole Association and also undertakes analytical research. Special methods have often to be developed: for instance, much research is concerned with the influence of trace elements, *e.g.* carbon and nitrogen, which cannot be determined accurately by conventional methods. In other cases, only very small samples are available, *e.g.* corrosion products, inclusions, segregates, etc., and special microchemical methods have therefore to be devised. New or unusual materials are frequently introduced during research projects and new methods have to be devised for analysing them.

In collaboration with W. Edwards (Vacuum) Limited, a robust vacuum-fusion gas-analysis apparatus, having an all-metal pumping system, has been satisfactorily developed (Fig. 2). The apparatus is now in daily use supporting work on production of pure iron and on steel-making reactions, while improvements continue to be made. The characteristics of spectrographic source units and the sensitivity and reproducibility of analysis under various arc-like and spark-like conditions have been studied. One limitation of spectrographic analysis has been the difficulty of obtaining suitable metal standards. This has to some extent been avoided by using solutions which are standardized against solutions of pure chemicals.

Iron and Steel Freight Charges

An increase of 25s. per ton on iron and steel rates from Europe to all destinations in the Far East is to be introduced by the Conference Lines from October 1. The increase applies to shipments for which carrying tonnage has not already been booked with the lines or their agents. The Conference Lines are those represented in the Far Eastern Freight Conference, the Japan Outward Freight Conference, and the Philippines-Europe Conference.

The immediate introduction of a surcharge of 15 per cent. net. (no discounts or rebates) on base rates of freight from the United Kingdom and North Continental ports was also announced by the Conference Lines and came into operation on September 18. The surcharge on the tariff rates on all commodities is applicable to ships which commenced to load at the port concerned on or after September 18 and on through bills of lading from outports dated September 18 onwards.

The Lines have had to take this action because of delays in passing through the Suez Canal and also to cover the possible necessity of re-routing certain ships via the Cape or Panama.

The new iron and steel rates are subject to the special surcharge of 15 per cent., except in the case of the new rates to Japan. For shipments of iron and steel to Japan a surcharge of 30s. net per ton (no discounts or rebates) is to be made applicable to new bookings for shipment from October 1. This is because the anticipated movement of steel to Japan during the closing months of 1956 and early in 1957 has increased to a quantity beyond the availability of the lines' berth tonnage. An effort to charter additional vessels will be made whenever practicable and reasonable, in order to assist shippers. The surcharge is a contribution towards the cost of chartering and will be made irrespective of whether shipment is in berth or chartered vessels.

British Drills at Kariba

Orders for British drilling equipment have been placed by Impressit South Africa (Pty.), Limited, the Italian group of contractors responsible for major sections of the Kariba gorge hydro-electric scheme in Rhodesia. Rock drills, made by Holman Bros., Limited, Camborne (Cornwall), will be supplied for such vital parts of the scheme as the underground power station to be cut from the rock of the Zambesi gorge. Plant will be supplied from the firm's South African factory at Johannesburg, which already supplies more than half the rock drills in use in the Rhodesias. Among users at Kariba will be engineers already familiar with similar equipment on the goldfields. Delivery and service will be arranged from a special depot at Salisbury. Similar equipment is already in use at the site. The Cementation Company, Limited, is using these drills for the diversion tunnel. These will be taken over by the Italians when this tunnel—which diverts the river under the south bank while part of the main dam is built—is completed.

Nearly 200 Holman machines will thus be responsible for the greater part of the drilling at Kariba. The scheme will control the entire volume of the Zambesi, the artificial lake thus formed being 1,000 miles in perimeter—a project which has been called the most important single event in the history of the Federation. It will provide power for Rhodesian industry, saving an estimated £10,000,000 annually.

THE BRITISH TRANSPORT COMMISSION have issued an artistic folder, containing leaflets illustrating and describing 18 examples of vehicles varying from a 10 cwt. van for light delivery work, to specially constructed vehicles. These vehicles are available for contract hire which at least does save capital outlay. Details are available by writing to British Road Services, 222, Marylebone Road, London, N.W.1.

Equipment & Supplies

Bearing Alloy

The Owen Organization announces that C. & L. Hill, Limited, Stringes Lane, Willenhall, Staffs, have commenced the manufacture and sale of "Alzen 305" in ingot form, of which they have the sole right, plus a non-exclusive licence for castings and fabricated parts.

This alloy, which is a bearing metal, is covered by British Patent No. 725,818 and has a composition of 30 to 40 per cent. aluminium, 5 to 10 per cent. copper and the balance zinc. It exhibits a structure similar in form to the tin bronzes, namely a finely distributed, hard, ternary eutectic of copper/aluminium/zinc in a relatively soft matrix of zinc/aluminium. The specific gravity of Alzin 305, when chill cast, is 4.8; the approximate yield stress 15 tons per sq. in., the tensile stress 20 tons per sq. in.; elongation 2 per cent. and Brinell hardness 100 to 150. The Patent rights have been acquired from the United Iron and Steel Company, of Austria, and by their acquisition Alzin, Limited, have exclusive rights for 20 years in the British Commonwealth, USA, Sweden, Spain, Japan, and non-exclusive rights in many other countries.

Portable-electric Drills

A new range of industrial portable-electric drills has been introduced by Wolf Electric Tools, Limited, Pioneer Works, Hanger Lane, London, W.5. These drills range from $\frac{1}{4}$ to $\frac{1}{2}$ in. capacity and it is claimed that performances expressed in inches per minute penetration and translated into production drilling time, represent an average saving of $5\frac{1}{2}$ hours in every ten taken by earlier makes. The inside of the switch handle and switch-handle cover adjacent to the live switch parts is covered with a permanently moulded layer of insulating material for which British and Foreign Patents have been applied, and a special arrangement for the incoming cable and earth wire is also included for maximum safety, the earth position being marked both with an "E" and the international earth sign. The drills are supplied with two power outputs—the $\frac{1}{4}$ and $\frac{1}{2}$ in. capacity machines are fitted with motors of 0·275 b.h.p., while the $\frac{5}{16}$ and $\frac{1}{2}$ in. capacity tools are powered by 0·33 b.h.p. motors. A complete range of accessories is available including drill stands, and television and radio suppressors.

Twin-Arc Welding

To meet the increased demand for all-steel foundry moulding boxes in conjunction with the labour force available, Sterling Foundry Specialties, Limited, of Jarrow-on-Tyne, are now using the Twin-Arc welding process. This process is a manual operation which combines the flexibility of single-arc manual welding with the increased speeds of automatic welding. It is claimed to be of particular use where the expense of automatic equipment is not warranted. In one case using R6 swg electrodes, a 25-in. fillet weld took 1 min. 55 sec. as against 4 min. 7 sec. with ordinary hand welding using 4 swg single-arc electrodes. The time saving of 2 min. 12 sec. allowed for the fact that with twinned electrodes the weld was completed without a stop to change the electrode. The weld profile was also better, showing no tendency to undercutting, while root penetration was improved and slag removal much easier. Quasi-Arc, Limited, are sole concessionaires for Twin-Arc welding plant, manufactured by the General Electric Company of England.

FIG. 1.—*Wire-twister developed by Douglas Kane Associates of London, W.1.*

Wire-twister

Douglas Kane Associates, of 5, New Quebec Street, London, W.1, announce a new range of tools to twist wire for securing bundles, bags, coils, hampers, etc. The "Unibind" wire-twister eliminates the need for special "wire-ties" which are commonly used and, therefore, offers a worthwhile saving in terms of wire consumption. After placing the wire around the object to be tied and into the slot of the twisting blade, a few pulls on the handle cause this blade to rotate until the wire is tightly twisted. The unit illustrated in Fig. 1 has a spool of approximately 100 ft. of 18 gauge wire, sufficient for over 150 ties, and, when empty, a new spool is easily inserted. Another model features a cutter in the place of the wire spool, and this enables it to twist also heavier-gauge wire up to 16 s.w.g., which it cuts off automatically from a coil when the handle is pulled and then continues the twisting. Either model will twist the wire as tightly as required in a matter of seconds, and then shear it off at the end of the twist.

Resin/Sand Coating Muller

Shallway Corporation, Ninth and West Crawford Streets, Connesville, Pennsylvania, USA, have introduced a plant for the production of pre-coated shell-moulding sands. With the plant as an accessory goes a skip loader. In addition, the firm recommends the use of a proprietary material, SCA-30 accelerator, instead of alcohol and water. Figures indicate that spraying this in is preferable to pouring as it gives 30 to 40 lbs. per sq. in. greater tensile strength to the baked shell. Another claim is that by the use of the muller an extra 100 lb. per sq. in. is given to the biscuit. The cycle when using spraying is of the order of 12 to 15 min. The muller is available in three sizes, 125, 300 and 1,000 lb. capacity.

Welding Helmet

Panorama Equipment Limited, 29/36, Seymour Mews, Wigmore Street, London, W.1, are introducing this month a new design of welding helmet. This will incorporate the following practical improvements: (1) a flip-front glass holder, which allows quick observation of work without raising the helmet; (2) a rachet-type adjustable cushion headband, allowing for improved back balance, and (4) a three-position adjustable chin rest.

Clean Air Act*

Application to Ironfounding

The Clean Air Act has received the Royal Assent. The Minister of Housing and Local Government has the power to fix the days on which the various parts of the Act shall come into force. It is expected that the appointed day for the industrial provisions will be in 1958.

The administration of the Clean Air Act will be carried out by the local authorities with the exception of those processes controlled under the Alkali, etc., Works Regulation Act, 1906. The ironfounding processes are not so controlled and the Clean Air Act does not specify which processes shall be controlled under the Alkali Act. The Minister has powers under Section 17 of the Clean Air Act to extend the list of processes scheduled under the Alkali Act after a public enquiry. (Under Sections 1, 5, and 16, the prohibition of dark smoke from chimneys, the requirement that dust and grit from furnaces shall be minimized, and the abatement of smoke nuisances will still apply to all scheduled processes although a local authority may not take proceedings for a breach of those sections without the consent of the Minister.)

Position of Ironfounding

The Council of Ironfoundry Associations will make an application for the ironfounding processes to be scheduled which, if successful, would mean that the industry's processes would in general be subject to the control of the Alkali Inspectorate.

No details are yet available about the procedure for the public enquiry. The Ministry expects to make an announcement about this in the autumn. There is not much doubt that the local authorities will object to the extension of the list of scheduled processes. This means that the case for the ironfounding industry must be put with equal force supported by fullest technical data. The preparation of the case will be begun shortly in anticipation of the Ministry's announcement. The CFA hopes that the public inquiry will be held and the Minister's decision known well before the coming into operation of those provisions of the Act which affect ironfoundries.

An attempt was made by the CFA to secure amendments to Sections 6 and 7 (requiring new furnaces to be fitted with grit and dust arrestors and the measurement of grit and dust emitted from furnaces). The Minister was urged to receive a deputation to hear the CFA's objections. The Minister was unwilling to do this, maintaining that the decision to extend the scope of these clauses was a deliberate one based on careful consideration of all the circumstances. In fact, the Minister's reply did no more than reiterate statements previously made. In reply the CFA expressed its disappointment at the Minister's attitude, refuting his contentions but placing the main emphasis on the Minister's exercising his powers to exempt the industry from these and other clauses by bringing it under the Alkali Act when the public inquiry had been held.

A summary of the main provisions of the Act† is given below. When considering these in relation to the likely effect on their own foundries, firms will find it helpful to refer to notes‡ prepared by the British Cast Iron Research Association on measures which can be taken to minimize the emission of dust, grit and smoke.

The Act stems from the Report of the Committee on Air Pollution (the Beaver Committee—Cmd. 9322, November, 1954) and in general it implements the recommendations of that Committee. This summary does not cover all the provisions of the Act.

Dark Smoke

Section 1.—The emission of dark smoke from a chimney is prohibited, except within certain limits or classes specified by the Minister. In the event of a contravention of this section it would be a defence to prove that it was due to (*a*) lighting up a cold furnace; (*b*) an unforeseeable and unavoidable failure of the furnace or equipment; (*c*) the use of unsuitable fuel, suitable fuel being unobtainable and that the least unsuitable fuel obtainable was used. If defences (*a*) and (*c*) are used it would also be necessary to prove that all practicable measures had been taken to prevent the emission. Section 2 provides that until 1963 it will be a defence under Section 1 to prove that the contravention was due to the nature of the building and equipment and not to failure in use or maintenance, and that it had not been practicable to make the necessary alterations. Local authorities *may* issue certificates, renewable annually, stating that they are satisfied that it had not been practicable to make the required alterations. No certificate will remain in force after 1963.

Smoke from Furnaces

Section 3.—All new furnaces must be capable (so far as practicable) of being operated continuously without emitting smoke when burning fuel of the type for which they were designed. Plans and specifications for a new furnace may be submitted to the local authority and if approved shall be deemed to comply with the provisions of this section. The local authority must be notified of the installation of all new furnaces.

NOTE.—This section says: "So far as practicable no smoke shall be emitted." Since cupolas are designed to burn a smokeless fuel, it is expected that they will comply with the requirements of this section.

Measurement of Smoke

Section 4.—The Minister may make regulations requiring the installation of apparatus for indicating or recording the density of smoke and for making such records known to the local authority.

Grit and Dust from Furnaces

Section 5.—All practicable means must be used to minimize the emission of grit and dust from non-domestic furnaces.

Section 6.—All new furnaces burning pulverized fuel, new furnaces burning other solid fuel at the rate of one ton an hour or more, must be fitted with grit and dust arresting plant. The plans and specifications for such plant must be submitted to and approved by the local authority. Appeals against the decisions of local authorities may be made to the Minister. The Minister may give directions to local authorities requiring specified classes of applications to be referred to him for decision.

Section 7.—The Minister may make regulations requiring the installation of grit and dust measuring apparatus in the case of all furnaces burning pulverized fuel, those burning other solid fuel at the rate of one ton an hour or more. If the Minister makes such regulations the local authority must serve notice to the occupier that the regulations are to apply to his furnaces or ovens.

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* Extracted from a *General Bulletin* of the Council of Ironfoundry Associations.

† Copies of the Clean Air Act are obtainable from HMSO, price 1s. 9d. net.

‡ Published by the BCIRA in *Broadsheet No.* 1, copies of which are available on application to the Association, at Bordesley Hall, Alvechurch, Birmingham.

Clean Air Act

Section 8.—The local authority may demand such information as it may reasonably require about furnaces and the fuel consumed in order to fulfil its functions under Sections 6 and 7.

Height of Chimneys

Section 10.—If plans submitted in accordance with building bye-laws show that it is proposed to construct a chimney, the local authority may reject them if it is not satisfied that the height of the chimney is sufficient to prevent, as far as practicable, smoke grit, dust or gases from becoming prejudicial to health or a nuisance. If the plans are rejected an appeal may be made to the Minister.

Smoke Nuisances

Section 16.—This section is complementary to Section 1. It deals with all smoke, other than dark smoke under Section 1 and domestic smoke. If the smoke with which this section is concerned is a nuisance to the inhabitants of the neighbourhood it shall be deemed a statutory nuisance for the purposes of Part III of the Public Health Act, 1936. The section provides for proceedings to be brought and specifies that in the case of smoke emitted from a chimney it shall be a defence to prove that the best practicable means have been used to prevent it.

Special Cases

Section 17.—Subsection (1) states that Sections 1-16 shall not apply to premises controlled under the Alkali Act except that a local authority may bring proceedings in respect of such premises under Section 1, 5 and 16 with the consent of the Minister. The Alkali Act is extended to cover smoke, grit and dust from scheduled processes.

Subsection (2) empowers the Minister to make orders transferring the whole or part of any scheduled premises from control under the Alkali Act to the local authority in respect of smoke only.

Subsection (3) gives the Minister power to vary or revoke the list of works controlled under the Alkali Act in the same way as he has power to extend the list under the Public Health Act, 1926. This Act requires the Minister to hold a public inquiry before extending the list of scheduled processes.

Definitions

Section 34 defines various terms used in the Act. "Chimney" includes structures and openings of any kind from or through which smoke or (where the reference is to the chimney serving an oven) grit or dust may be emitted, and references to a chimney of a building include references to a chimney which serves the whole or part of a building but is structurally separate therefrom. "Practicable" means reasonably practicable having regard, among other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge, and "practicable means" includes the provision and maintenance of plant and the proper use thereof. "Smoke" includes soot, ash, grit and gritty particles emitted in smoke. "Dark Smoke" means smoke as dark as or darker than Shade 2 on the Ringelmann Chart. If, however, the court is satisfied that the smoke is or is not dark smoke as defined, it is not necessary that there should have been a comparison with a Ringelmann Chart. The Minister may make regulations defining other methods of ascertaining whether smoke is dark.

Manpower Movements in Industry

One of the primary aims of the Government's credit squeeze and of purchase-tax policy has been to secure a transference of labour from the less essential home trades to industries vital to the export markets. It is unlikely to be entirely pleased with the latest statistics. Tables published in the *Ministry of Labour Gazette* show that workers were still leaving the manufacturing industries at an undiminished rate at the end of June, while there was an increase in employment in the food, drink, and tobacco industries, in the distributive trades, and in agriculture.

Seasonal trends may partly account for the increased employment in some trades, but the tables show that key industries have lost substantial numbers of workers, and it would not appear that, for example, the engineering industries have gained generally from the slacker conditions in motor-car manufacture, one of the first industries to be affected by the restrictions on credit.

Major Losses

Among major groups of industries which have lost workers are metal manufacture; engineering, metal goods, and precision instruments; and vehicle manufacture. Others are textiles and clothing. Groups of industries which have been recruiting labour to an important extent include food, drink, and tobacco; building; the distributive trades; "professional, financial, and miscellaneous services"; transport, and agriculture.

The engineering industry has lost 34,000 workers since February, and the vehicle-building industry 21,000. Altogether 25,890 were unemployed in the motor industry at the end of June, although 321,300 were still employed. Unemployment is higher in the Midlands than in any other part of the country, with 40,548 persons out of work on July 16, an increase of nearly 15,000 in a month. In the north-west of England on the same date 35,772 were unemployed, a third of them in Liverpool.

Overall, employment is higher. It is estimated that the number of persons in civil employment in Britain rose during June by 14,000. The total working population, including the forces, is estimated to have increased by 5,000 to 23,989,000.

The Ministry of Labour has also published figures of industrial disputes. These show the loss of 286,000 working days in the United Kingdom in July, against 138,000 in June and only 90,000 in July, 1955. However, in the first seven months of the year less than half the number of working days were lost—1,402,000 compared with 2,897,000.

In July the biggest losses of working time were in metal manufacturing (125,000 days), the vehicle industry (117,000), coal mining (20,000), and ship building and repairing (11,000).

Scottish Foundry Trade

Some branches of the foundry trade in Scotland, subject to seasonal fluctuations, appeared to be quieter during the earlier summer months, but there is evidence that a convincing recovery was made during August. Even for those specializing in the manufacture of domestic appliances, and for the alloy foundries where it could have been expected that the economic situation might have an adverse effect on trade, there would seem to be a continuing steady flow of new business. In general, supplies of foundry and haematite pig-iron are adequate, and, for the remainder of this year, the prospects for the foundry trade continue to be bright.

Fordath Engineering Company, Limited

Keeping Pace with Developments in the Foundry Industry

The foundry industry of Great Britain has made impressive progress since the war, and a survey of what has been effected by firms servicing it is of major interest, for generally speaking, the progress made by the former is largely dependent on the ingenuity and quality of the machines and supplies provided by the latter. The Fordath Engineering Company, Limited, whose works are situated on an arterial road under construction at Albion Road, West Bromwich, is a good example of a concern which is determined to be in the forefront of modern progress. The company was founded in 1920 by Major J. W. Athey, Dr. D. J. Bedford and Mr. J. W. Sutcliffe. Until 1930, its main activity was the manufacture of a range of core compounds. In this year, several lines of foundry plant were developed, the best known being the Fordath sand mixer, of which over 1,400 have been sold.

Specialized Departments

These lines of business tend to exclude the concentration of manufacture in one large building; for one thing, there is always a fire hazard when dealing with vegetable oils. Thus, the plant at West Bromwich consists of several self-contained shops each devoted to one particular purpose—that is there are buildings set aside for the making of semi-solid core compounds; the more-liquid ones; and another for cereal binders in powder form. In addition, there is a machine shop; two erecting shops and a large control laboratory. A programme of rebuilding and re-equipment was initiated about three years ago and the net result has been an increase of productive capacity of the order of 50 per cent., the number of employees remaining constant at about 100. A concrete example of this development can be cited in the case of the new shop engaged on the production of semi-solid compounds. (See Fig. 1.) Here, as is the case of most of the raw materials, the vegetable oil arrives by bulk road tanker and is pumped up to one of three containers situated at a level higher than the mixing plants. By gravity flow, the oils are metered to the Baker Perkins mixers. Powdered raw material, stored on pallets, is handled by fork-lift trucks and carefully weighed into the mills. The finished products are loaded into drums and again, after weighing, are pallet stacked. The mechanical-handling system has trebled the shop's former capacity, with a 25 per cent. reduction in manpower. It is interesting to note that this shop is heated by Pyro-tenax cable embedded in the concrete floor. Using a night load, this system has given every satisfaction during the winter months.

Other Aids to Production

In the Permol shop, improvements have been made through the installation of a 120 kw. Isolectric equipment for the heat-treatment of vegetable oils. As weighing machines are essential for the manufacturing control of solid raw materials, so, too, when dealing with liquids, preset meters have been deemed necessary for the orderly production of standardized outputs. Throughout the factory there are numerous aids to production, such as short lengths of roller paths, elevating belt conveyors and ingenious gadgets for handling drums.

The reorganization of the machine-shop is nearly complete—belt drives have been replaced by individual motors, and the machine tools are all painted green and are placed in echelon formation at an angle to the wall, so that the operators have a clearer working space around their machines and

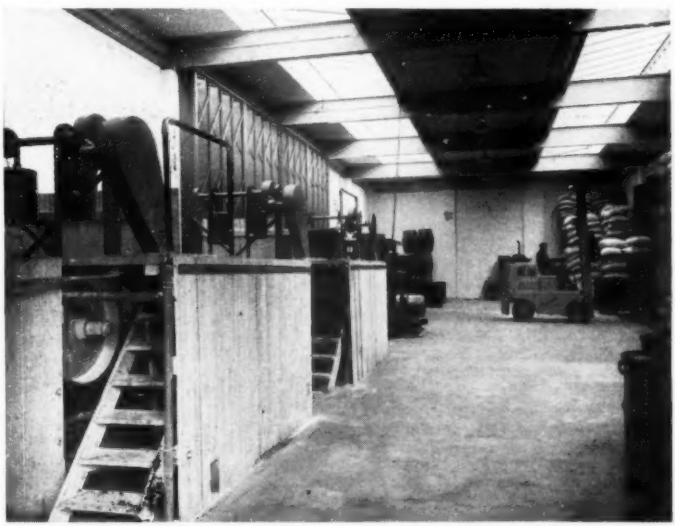

FIG. 1.—*View of the department of Fordath Engineering Company, Limited, where the semi-solid core-binders are manufactured. Space heating of the shop is effected by electric wires embedded in the floor. Handling of both solid and liquid raw materials is mechanized.*

Fordath Engineering Company, Limited

no longer face a blank wall all day. A production-bonus system has been inaugurated and is working satisfactorily.

This is no place to speak of the products—which have sales value of three quarters of a million pounds a year—of the company, beyond a bald statement that every effort is made to satisfy the needs of the ever-changing pattern of core production, be it shell-moulding, the CO_2 Process or the new cold-setting binders.

Company News

POWER-GAS CORPORATION, LIMITED—The company is to raise £1,000,000 through a two-for-five rights issue of ordinary 10s. shares at 25s. per share. Treasury consent has been received. The issue is being made to finance the third phase of the company's development programme. For the first 11 months of the current financial year, the value of orders taken was £12,000,000 approximately, compared with the previous year's record figure of £10,750,000. The directors believe that profits for the current year will not be less than those for the previous year and forecast a dividend of 14 per cent., as before, on the existing capital. The directors intend to pay interim dividends in future and the new shares will rank for the first interim which will be payable about October, 1957. The final will be paid the following March.

HORSELEY BRIDGE & THOMAS PIGGOTT, LIMITED, constructional engineers, ironfounders, etc., of Tipton (Staffs)—The chairman, Mr. J. V. Sheffield, states that the high inflationary factor in wages, materials, and services during and since the war has considerably increased the costs of production and a greater working capital may be required to finance current trading, costs of development, and new plant. It may, therefore, he says, be necessary to raise additional new money. The authorized ordinary capital is to be doubled to £1,500,000, but this action, Mr. Sheffield says, is purely preliminary and the directors have no intention at the moment of issuing any additional share capital. Although group trading profits for the year ended March 31, at £324,852, shows a reduction of £16,739 over 1954-55, the accounts are influenced by the final settlement of long-term contracts and this tends to give rise to variations in profit over the years.

DELTA METAL COMPANY, LIMITED.—Terms for the company's proposed merger with Mansill, Booth & Company, Limited, Smethwick, and Elkington & Company, Limited, Walsall, mentioned in our last issue, have now been announced. For every three Mansill Booth shares, holders will be offered two Delta Metal shares, plus £3 13s. 3d. in cash. Holders of every three Elkington "A" shares will be offered one Delta Metal share plus £2 13s. 6d. For every 20 Elkington "B" shares the consideration is one Delta Metal share plus £5 4s. 2d. in cash. The offer is subject to any necessary consent being obtained from the Treasury. The joining of the three companies would bring together assets totalling approximately £10,000,000. Issued capital of the Delta Metal Company is £1,750,000 in 5s. shares having a market value of 20s. 10½d. Mansill, Booth & Company's capital is £330,000 in 5s. shares valued in the market at 36s. Elkington & Company's capital consists of £150,000 in 6 per cent. £1 cumulative preference shares, £460,000 in £1 "A" ordinary shares with a market value of 23s. 1½d. and £20,000 in 5s. "B" shares.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

PRESTON, September 30—Castings (manhole covers, gully grates, etc.), for the Lancashire County Council. The County Surveyor, County Hall, Preston (PO Box 9).

SOUTH AFRICA, October 5—Cast-iron chairs for permanent way, for the Stores Department, South African Railways. (ESB/23171/56.)

SOUTH AFRICA, October 5—Cast-iron chairs or soleplates for permanent way, for the Stores Department, South African Railways, Johannesburg. (ESB/23149/56.)

BURMA, October 17—Air compressors, for the Union of Burma Purchase Board, Rangoon. (ESB/23663/56.)

FORMOSA, October 5—Machine tools, hand tools, etc., for the Central Trust of China, Purchasing Department. (ESB/22988/56/ICA.)

FORMOSA, October 15—Industrial machinery, for the Central Trust of China, Purchasing Department. (ESB/23468/56/ICA.)

INDIA, October 1—Low-tension switchgear, for the Stores Purchase Committee, Government of Mysore. (ESB/23193/56.)

INDIA, October 5—Air compressors, for the Director-General of Supplies and Disposals, New Delhi. (ESB/23128/56.)

INDIA, October 5—Diesel electric mobile crane, for the Director-General of Supplies and Disposals, New Delhi. (ESB/23378/56.)

Forthcoming Events

OCTOBER 1

Institute of Industrial Supervisors

Ayrshire section: "Responsibilities of the Foreman," by D. Gilmour, at 7.30 p.m., at the Royal Ordnance Factory Sports Club, Irvine.

OCTOBER 2

Incorporated Plant Engineers

London branch: "Treatment and Disposal of Industrial Effluent," by J. Lakin, 7 p.m., at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2. (Tea 6.30 p.m.)

Institution of Production Engineers

Leicester section: "Ultrasonic Machining of Hard Materials," by C. Brokleabury, B.Sc., 7.30 p.m., at the Windsor Room, Bell Hotel.

OCTOBER 3

Institute of British Foundrymen

Southampton section: "Investment Casting Process," by D. F. B. Tedds, 7.30 p.m., at the Technical College, St. Mary Street.

Institution of Production Engineers

South Essex section: "Trade Unions and Industrial Development," by R. Harle, 7.30 p.m., at the Mid-Essex Technical College, Chelmsford.

Incorporated Plant Engineers

Leicester branch: "Power Transmission," 6.30 p.m., at the Leicester College of Art and Technology.

OCTOBER 4-5

Institute of Vitreous Enamellers

Annual conference at the Hotel Metropole, Brighton. Thursday, October 4, annual general meeting and symposium on mechanical handling; Friday, October 5, technical sessions, and in the evening the annual dinner/dance at the Winter Gardens, commencing 8 p.m.

OCTOBER 4

Incorporated Plant Engineers

Peterborough branch: "Design of Condensing and Feed Heating Plant," by J. Denton, 7.30 p.m., at the White Lion Hotel, Church Street.

OCTOBER 6

Institute of British Foundrymen

Bristol and West of England branch: "Production of Large Steel Castings," by J. H. Pearce, 3 p.m., at the Bristol College of Technology, Unity Street, Bristol.

West Riding of Yorkshire branch: Lecture by C. R. van der Ben and H. Haynes, 6.30 p.m., at the Technical College, Bradford.

News in Brief

NEW PREMISES of British Insulated Callender's Cables, Limited, have been opened at Spital House, 87, Spital Street, Sheffield.

JOHN HILL AND SONS (IRONFOUNDERS), LIMITED, is having an extension erected to the foundry in Albion Street, Horseley Fields, Wolverhampton.

RANSOMES & RAPIER, LIMITED, Waterside Works, Ipswich, announce that they are now users of the Telex method of communication, their call number being 27—2600 Rapier, Ipswich.

TWENTY MEMBERS of the Stafford Universal Grinding Wheel Company's Foremen's Association visited the Sheffield factories of the David Brown Industries group during the weekend of September 15-16.

NEW high-performance sparking plugs using silver as well as platinum to give maximum efficiency will be introduced by the K.L.G. company at the London Motor Show, to be held at Earls Court, October 17 to 27.

PETER BROTHERHOOD, LIMITED, engineers and ironfounders, of Peterborough, has erected by the side of the main line from Kings Cross to Edinburgh, a sign 80 yds. long and 12 ft. high. Ten spotlights illuminate the sign at night.

A CONTRACT worth over £300,000 has been awarded to the English Electric Company, Limited, for switchgear and cabling for the first stage in Venezuela's hydro-electric power scheme at Caroni. The new steelworks in the Guayana district will be supplied by the scheme.

Sir GEORGE BARNETT, H.M. Inspector of Factories, officially opened a new baths centre at the East Hecla Works of Hadfields, Limited, Sheffield, on September 15. It accommodates 150 people and is one of a system of washing centres to be constructed throughout the company's premises.

CORROSION, LIMITED, 16, Gloucester Place, Portman Square, London, W.1, announce the introduction of B.P.F. (blue-print protective fluid), a plastic fluid for the protection of blue-prints, work cards, process sheets, maps and other types of document that need protection during handling and storage.

A NEW branch office has been opened by the Ransome & Marles Bearing Company, Limited, Newark-on-Trent, at 58-60, Paradise Street, Liverpool, 1 (telephone: Royal 7331). The manager is Mr. E. L. Paton. The telephone numbers of the company's office at 4, Great Central Street, Leicester, are now 24739 and 24730.

THE third bi-annual visit to Shropshire of employees of the Northern group of the Allied Ironfounders (Falkirk Area) took place on September 8, when a party of 36 employees arrived at Ketley and were welcomed by Mr. S. Cotton (chairman of the Ketley works social and athletic club) on behalf of the members of the club.

IT IS ANNOUNCED that about £25,000 worth of new equipment has been added to the existing engineering machinery at the Keighley Technical College, and that the machinery has all been transferred to new quarters in the basement of the five-storey extension adjoining the present premises, the basement having now been brought into use.

A NEW SCHOOL opened by the Dunlop Rubber Company, Limited, at Fort Dunlop, gives 25 apprentice engineers a 12 months' course in milling, turning, and grinding. They attend lectures and demonstrations on such allied technical subjects as workshop calculations, drawing office practice, machine maintenance, electrical installation, and pipe-fitting.

A £300,000 ORDER to build, instal, and have in operation by May 15, 1957, diesel-electric generating equipment for the Baghdad Electricity Service's new "peak load" power station at Muasker al-Rashid has been won by the Brush Group, Limited. It is reported that the contract was awarded to the group because of its ability to complete the contract in a shorter time than any other manufacturer.

AN EXTENSIVE RANGE of air compressors, power tools and accessories will be displayed by the Consolidated Pneumatic Tool Company, Limited, Dawes Road, London, S.W.6, on Stand No. 59 (Grand Hall annexe) at the Public Works exhibition to be held at Olympia, November 12 to 19. An entirely new exhibit is an electrically-driven stationary portable air-compressor of 365 cub. ft. capacity.

OFFICIAL OPENING of the new £1,000,000 dry dock of Brigham & Cowan, Limited, took place at South Shields on September 14. Mr. S. Wingfield Digby, Civil Lord of the Admiralty, performed the ceremony by unveiling a stone tablet. It is the second new dock to be completed on the Tyne since the end of the war. Swan, Hunter, & Wigham Richardson, Limited, Wallsend, is building a dock which will take vessels up to 45,000 tons d.w.

RUMOURS THAT IT INTENDS to withdraw from India are denied by the A. B. C. Coupler & Engineering Company, Limited. It is pointed out that the company is still doing business there through the A. B. C. Coupler & Engineering Company (India), Limited. The firm owns no land in India—what little it had was sold soon after the war—so rumours that the company is selling its land in India are also false, states the managing director.

SMITH AND NEPHEW, LIMITED, Bessemer Road, Welwyn Garden City, Herts, are showing at the Purchasing Officers' Association's Minibition, a new tape, called Lasso Zebra warning tape, which, printed in vivid "zebra" stripes, gives instant warning of danger points and emphasizes them so that it is impossible not to notice such things as low girders or beams; dangerous fuse boxes; isolated pillars in large areas of floor space, and other potential dangers.

THE APPLEBY-FRODINGHAM STEEL COMPANY (a branch of the United Steel Companies, Limited), which is replacing one of its finishing plate mills, has ordered from Metropolitan-Vickers Electrical Company, Limited, electrical equipment worth over £350,000. This will be used on a new four-high reversing hot mill to be installed at the Appleby Steelworks, Scunthorpe, Lincolnshire. The mill will take steel slabs weighing up to 16,000 lb. and roll them into plates up to 65 ft. long and 11 ft. 4 in. finished width. The minimum plate thickness at this width is 0.30 in.

ROSYTH DOCKYARD now has the foremost technical training facilities for dockyard apprentices in the country. A £50,000 apprentices' training centre was opened on September 10 by Rear-Admiral P. Skelton, Admiral Superintendent of the dockyard. The two-storey building, equipped with modern machinery, is the first of its kind in Royal dockyards. It caters for about 150 first-year apprentices. On the ground floor of the new building there are four workshops for metal and wood workers, electrical fitters and fitters' shops. In addition there are two lecture and demonstration

News in Brief

rooms and offices. The first floor comprises a cinema, recreation, lecture and demonstration rooms; the building is centrally heated.

WORKINGTON IRON AND STEEL COMPANY, a branch of the United Steel Companies, Limited, have just commissioned a £60,000 turbo-blower at their blast-furnace plant, which will enable the company's three blast furnaces to operate simultaneously at full capacity. It had formerly been the practice to keep only two furnaces in blast, while the third was off for relining and repairs. The new turbo-blower (which replaces a 35-year-old unit now being retained as a stand-by) is capable of supplying sufficient air to burn 4,620 tons of coke per week, equivalent to an iron output of 5,000 to 5,500 tons. It was designed and made by the British Thomson-Houston Company, Limited.

DESCENDANTS of the famous trio associated with the Soho Foundry, James Watt, William Murdock and Matthew Boulton, attended the ceremony in Birmingham on September 14, when statues of the three pioneers were unveiled. First envisaged in 1938, and now sculptured by Mr. William Bloye, the statues, 10 ft. high, stand on a pedestal of Portland stone. The unveiling ceremony, which took place outside the Birmingham Commercial College in Broad Street, was performed by Sir Percy H. Mills, chairman of W. & T. Avery, Limited, owners of the historic old Soho Foundry. In his speech, Sir Percy Mills said that bearing in mind the benefits which the three pioneers of the Soho Foundry had given to the world, we should not be fearful of other discoveries they had made possible. These could produce results beyond the scope of unaided manual labour or even of the tools hitherto employed. Boulton, Watt and Murdock were men whose co-operation so changed the mode of life of mankind that their names were imperishable. Sir Percy Mills was thanked by Mr. W. B. Beard, vice-chairman of the Trades Union Congress, for performing the ceremony, which was attended by the Lord Mayor of Birmingham, Ald. E. W. Apps, members of the Birmingham City Council and eight descendants of the three men.

AT A MEETING at Birmingham University on September 8, organized by the Birmingham branch of the Institute of Production Engineers, Mr. D. R. Eaves, production manager of the Standard Motor Company, Limited, said that an employer, thinking of introducing automation, would have to weigh the capital cost of the machines, the installation costs and the fact that a large proportion of his factory would be unproductive for many months, against the future advantages of substantial saving of floor space, high efficiency, greater safety factor and the reduction of direct labour. Shop-floor supervision would be completely changed, Mr. Eaves said, for with mechanization, the supervisor's main aim would be to keep the plant producing. They would have to understand its functions technically, but they would also have to be responsible for, and constantly in touch with, the labour force that was directly controlling and maintaining the machines. A fresh approach might be needed in selecting supervisors. He foresaw that mechanization of handling would reduce the need for factory labourers and shop progress personnel while mechanical units for office installation would reduce the need for clerical workers on the accounting side. He suggested that the capacity for technical education for boys who were of full-time school age needed urgent attention and every effort should be directed towards attracting students for training as technicians and specialists.

Fuel Efficiency Exhibition

This year the Fuel Efficiency Exhibition will be held at Olympia, London, from October 2 to 10. Details of some of the exhibits having a particular interest to foundrymen are briefly given below. Makers of domestic and industrial fuel-burning appliances will find that the new regulations to secure efficiency and absence of smoke, dust and fume, have much influenced designs of equipment shown. In their own interest, therefore, founders who are affected by these changes are strongly advised to pay a visit to the exhibition. It is claimed that oil is now the cheapest fuel in this country if its heating value only be considered, and of course this fuel is making inroads into fields of application which were formerly served exclusively by solid fuel.

THE DISPLAY of Elcontrol, Limited, Wyndham Place, London, W.1, on stand No. 19, outer row, first floor, includes various control units for use with manually or automatically ignited gas and oil burners, and a photo-electric control unit which has been evolved particularly for use with light oil burners of the domestic type.

KEITH BLACKMAN, LIMITED, Mill Mead Road, London, N.17, are exhibiting on stand No. G8, ground floor, National Hall. As exhibit No. 4 they are showing a scale model of their Cupodel hot-blast cupola plant, which is being shown for the first time in this country. It is claimed that in this system coke savings of 20 per cent. can be made where metal of the same temperature as with cold blast is required.

MODERN INDUSTRIAL INSTRUMENTS for the measurement and automatic control of temperature, pressure, flow, and many other process variables will be displayed by Honeywell-Brown, Limited, Greenford, Middlesex, including the latest advance in miniature instrumentation—the Tel-O-Set recorder controller. This is a standard recorder and quick-connect controller suitable for all process variables. Another interesting exhibit will be the Electronic cam-operated programme controller. This instrument controls a process according to a time-temperature programme predetermined by the shape of a cam.

THE GAS COUNCIL on stand No. 5, row H, ground floor, National Hall, will have on show a high-speed tube-heating furnace, which can also be used for the treatment of bar and strip. Colourful wall panels will give visitors a good idea of several other applications of gas *i.e.* scale-free forging,, furnaceless heating, water heating and large-scale catering. To show the increased efficiency of coke utilization in recent years a full-size, cross-sectioned Trianco automatic industrial heating boiler will be on view. This appliance operates without attention and automatically maintains a pre-set temperature while giving an overall efficiency of fuel use of over 80 per cent.

KELVIN & HUGHES (INDUSTRIAL), LIMITED, 2, Caxton Street, London, W.1, on stand No. 12, first floor, National Hall, will be showing for the first time their smoke-density equipment Mk. 1, which is claimed to be suitable for all types of boiler plants. The basic equipment comprises a smoke detector assembly (transmitter and receiver units). This can be supplied with any one, or combination of, three additional instruments, an indicator, a recorder and an alarm circuit. The equipment is unaffected by voltage variation. A second new instrument is the photo-electric cell temperature controller (2-position). Other exhibits include a multiline recorder, pneumercator gauges, gas analyser primary unit, indicator units, flowmeters, programme controllers, portable pyrometers, draught gauges and a selection of thermocouples and sheaths.

In this type of sand mixer 'FULBOND' ensures an even mix with higher permeability and strength.

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CMF. 20

Personal

Mr. F. G. PHIPPS has been appointed a director of Davy and United Roll Foundry, Limited, manufacturers of rolls and steel castings, and Middlesbrough subsidiary of Davy and United Engineering Company, Limited.

Mr. LEONARD LEE, A.C.G.I., M.I.MECH.E., has resigned his position of chief engineer with James Howden & Company, Limited, to take up the appointment of general manager with Alldays & Onions, Limited, Birmingham.

Mr. AIREY NEAVE, D.S.O., O.B.E., M.C., Member of Parliament for Abingdon, Berks, has joined John Thompson, Limited, Wolverhampton, as their legal adviser. Mr. Neave has recently relinquished his appointment as Parliamentary Private Secretary to Mr. Lennox-Boyd, Colonial Secretary.

Mr. JAMES SHAW, chairman of Allied Ironfounders, Limited, will retire on October 31. Mr. W. T. WREN has been elected chairman as from that date, when he will resign the office of managing director. Mr. G. S. STEVEN, now deputy managing director, has been elected managing director from the same date. Mr. W. H. SMITH will continue to hold the office of vice-chairman.

Because of ill-health, Mr. W. POTTS, joint secretary of Swan, Hunter, & Wigham Richardson, Limited, the Wallsend shipbuilders, is to retire at the end of this month. He was not due to retire until the end of the year. Mr. Potts joined the company in 1920 as assistant to the then secretary, Mr. F. J. Culley. He was appointed joint secretary in 1945 with Mr. C. F. TURNBULL, who, on the retirement of Mr. Potts, will assume the entire secretarial duties of the company.

The appointment of Mr. J. B. ALLAN, B.SC. (ENG.), A.M.I.MECH.E., as general manager of the Acme Companies, in which are incorporated Acme Conveyors, Limited, Acme Ventilating, Limited, and Acme Welding & Constructional Engineering Company, Limited, has just been made. He has previously been on the technical staff of ICI, Limited, metals division, as mill manager of a large tube factory. Later he became an industrial consultant. During the war he served in the Royal Naval Volunteer Reserve as an air engineer officer.

Mr. E. JARVIS, who has retired after 36 years' service with the Appleby-Frodingham Steel Company, a branch of the United Steel Companies, Limited, has been associated with the iron and steel industry for 46 years. Shortly after going to Scunthorpe in 1920 to join the Appleby Iron Company, Limited (now the North Works), he became a chargehand fitter and then, in 1929, foreman fitter. Mr. Jarvis was made assistant engineer in 1947 and four years later he took up the position of senior engineer for the blast furnaces at the South Works, an appointment he held until his retirement.

Mr. G. F. ALEXANDER, who has been elected president of the South African branch of the Institute of British Foundrymen, comes from an engineering family as his father was at one time a director of Wellworthy, Limited. In 1922, as a young man, he took up farming in South Africa, but in 1934 he returned to the foundry industry to join his present company, Lumenite (Pty.), Limited, in a managerial capacity. The company originally manufactured aluminium pistons but in 1937 it opened a grey-iron foundry and now specializes in cylinder liners. Mr. Alexander is chairman of the company with his son as managing director.

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

753,393. American Cast Iron Pipe Company, Birmingham, Ala., USA.

Apparatus for centrifugally casting iron and steel tubing and similar tubular metal articles. It is more specifically directed to an improved form of metal mould particularly well adapted for use in the centrifugal-casting procedure described in B.P. 717,515.

753,624. Ateliers des Charnilles, S.A., 109, Route de Lyon, Geneva, Switzerland.

A process for reduction of iron ores by hydrogen and carbon monoxide in a tightly closed shaft furnace, (*a*) by heating the middle part of the furnace to the reduction temperature by electric induction heating, (*b*) by supplying ore and carbon mixed together in the upper part of the furnace in order to preheat them during their downward movement, (*c*) by introducing cold H_2 and CO into the lower part of the furnace in order to cool the downward movement of reduced ores and to preheat the gas. The preheated H_2 produces steam at the lower end of the reduction zone, the steam in turn producing a reaction with carbon thereby producing H_2 and CO, or (*d*) by introducing additional steel from outside into the lower part of the reduction zone for promoting the reaction.

753,641. Sarginson Bros., Limited, and R. H. Sarginson, Torrington Works, Coventry, Warwicks.

A method of, and means for, affecting a seal along the interface of two contacting planar surfaces. It aims to provide an efficient seal which need not be subjected to the full pressure applied for holding the surfaces in contact. The seal of this invention is particularly intended for protecting the contacting planar surfaces of foundry coreboxes, of the type in which the sand is blown into them by air pressure, from erosion due to the fine particles of sand being entrained by air leakage between them.

753,659. L. Nussbaum, Ray Court, Sheephouse Road, Maidenhead, Berks.

A composition consisting of titanium 50 to 60, iron 0 to 10, chromium 5 to 10, nickel 5 to 10, colombium 4 to 8, tantalum 0.4 to 1.0, and unavoidable impurities 0 to 1.0 by weight per cent. Carbon constitutes the remainder. The titanium, colombium, and tantalum are chemically combined with the carbon, the chromium and nickel being present in metallic condition. The product has a Rockwell A hardness of at least 88.

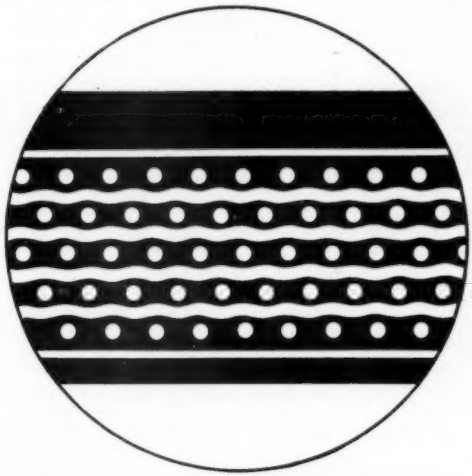
753,673. Aluminium Laboratories, Limited, 1800 Sun Life Building, Montreal, 2, Canada.

A process for casting sintered metal bodies into metals, for example, aluminium or aluminium alloys. The aims of the invention are to surmount the problems arising when the sintered metal bodies contain constituents which are readily oxidizable, as are found in aluminium and its alloys.

753,677. Klöckner-Hüttenwerk Haspe, A.G., Hagen-Haspe, Westphalia, Germany.

A process for the production in a converter of a steel low in phosphorus, nitrogen or oxygen, from a crude iron with a content of phosphorus 0.1 to 9.7, silicon 0.4 to 1.0, manganese 1.5 to 2.5, and carbon 3.8 to 4.5 per cent. The crude iron is blown in a single stage from beginning to end in a bottom blown converter with oxygen-enriched air or with an exothermic mixture of oxygen and steam with the addition, through the top of the converter during the blowing, of a quantity of lime and ore or mill scale all at once or in several portions.

Focus on conveyor belting proves Goodyear superiority



There is obviously only one way of proving to yourself beyond any doubt that Goodyear conveyor belting gives long and reliable service. That's by installing it.

But for proof in advance there's the record of efficiency of Goodyear conveyor belts in thousands of existing installations in this country—in steelworks, power stations, mines, quarries, factories and foundries.

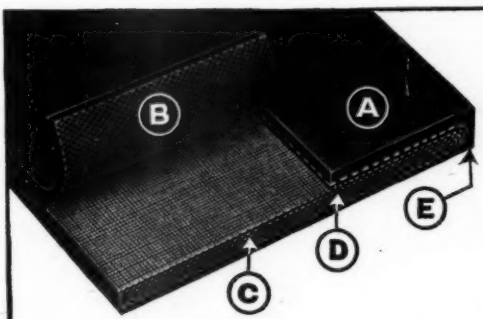
At a big steelworks, for instance, Goodyear belts conveying hot sinter are lasting over twice as long as other makes previously used.

QUICK PROOF

Focus on conveyor belting proves Goodyear superiority, and quickly confirms that Goodyear belting makes every conveying job an economic proposition.

The emphasis is on *every*. Whatever the conveying work, there's a "job-designed" Goodyear belt to do it at the lowest cost per ton.

This cost-saving is ensured by the exceptionally high quality built into every Goodyear belt. And this quality is ensured by rigid adherence to raw material specifications and stage by stage production inspection.



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A Tough, heavy-duty cover compounded to suit job.
B Breaker fabric to improve bond between cover and carcass—when required.
C Plies of close-woven duck, inhibited against mildew.
D Skim coat between plies prevents separation.
E Rugged edge cover resists wear.

QUICK DELIVERY

You can now get quick delivery of Goodyear conveyor belts, which are available with cotton or rayon carcass in any width up to 72 inches. They can be supplied in a few weeks against specific ordering.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

CONVEYOR BELTING · TRANSMISSION BELTING · V-BELTS · INDUSTRIAL HOSE

Pig-iron and Steel Production

Statistical Summary of July Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the past six months. Table II gives production of steel ingots and castings in July, and Table III, weekly average production of finished steel. Table IV gives the production of pig-iron and ferro-alloys in July, 1956, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	B.o.T. Price Index, 1938 = 100.			Iron-ore output.	Imptd. ore used.	Coke to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	I. & S.	Coal.	Basic[1] materials (excl. fuel)						Imports.[2]	Prod. ingots, castings.	Delivers. finished steel.	Stocks.[3]
1953	260	350	506	304	207	237	215	188	17	339	262	962
1954	263	364	498	299	234	238	229	198	7	356	277	931
1955	276	399	529	311	244	246	240	213	29	381	305	1,183
1956—Feb.[4]	285	437	538	315	284	269	263	226	37	418	332	1,220
Mar. ..	285	439	540	346	276	273	262	231	37	426	359	1,250
April ..	285	440	538	324	284	269	254	226	42	421	349	1,279
May[4]	297	433	541	306	274	255	247	213	29	396	321	1,306
June ..	300	461	539	302	256	252	240	209	27	380	324	1,315
July ..	300	462	535	288	252	258	240	179	24	326	—	1,337

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in July*, 1956.

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.8	11.8 (basic)	2.6	0.1	16.9	1.4	18.3
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.7	29.1	—	2.2	0.3	32.0	1.3	33.3
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	28.3	—	—	0.1	28.3	0.1	28.4
North-East Coast	1.1	63.4	—	1.5	0.5	64.4	2.1	66.5
Scotland	1.2	20.6	—	1.3	0.4	22.1	1.4	23.5
Staffs., Shrops., Worcs. and Warwick ..	—	19.2	—	1.4	0.6	19.3	1.9	21.2
S. Wales and Monmouthshire	5.4	68.9	7.2 (basic)	1.1	0.2	82.1	0.7	82.8
Sheffield (incl. small quantity in Manchester) ..	8.4	26.9	—	12.0	0.4	45.6	2.1	47.7
North-West Coast	0.1	1.8	2.5 (acid)	0.2	0.1	4.5	0.2	4.7
Total	17.9	262.0	21.5	22.3	2.7	315.2	11.2	326.4
June, 1956	20.8	310.2	21.2	24.5	3.0	367.0	12.7	379.7
July, 1955	14.8	251.7	21.9	17.1	2.2	299.3	8.4	307.7

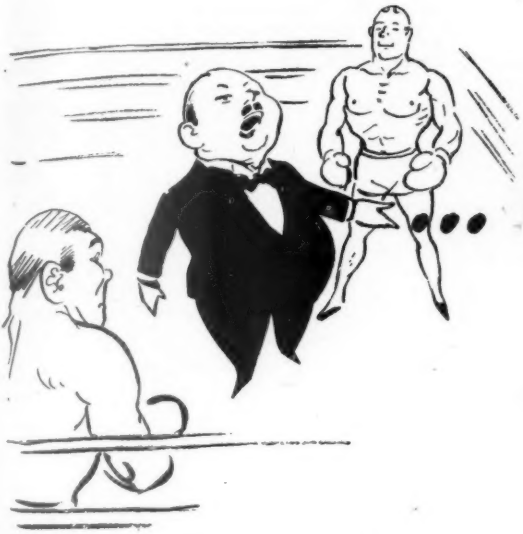
TABLE III.—*Production of New Non-alloy and Alloy Finished Steel.*

Product.	1954.	1955.	1955.	1956.	
			June.[4]	May.[4]	June.
Non-alloy steel:					
Ingots, blooms, billets and slabs[5]	5.1	4.9	4.9	4.8	4.7
Heavy rails ..	9.6	9.4	7.1	9.8	9.1
Sleepers, fish- and soleplates ..	1.9	2.0	1.6	1.8	1.9
Plates, ¼ in. thick and over ..	47.0	46.1	42.2	49.3	47.4
Other heavy prod.	45.8	47.8	47.8	52.7	51.3
Ferro-concrete bars and rods ..	5.9	7.0	5.9	7.0	8.1
Wire rods (incl. coiled rods, etc.)	19.7	22.2	22.5	24.0	23.1
Light rolled prod...	41.2	46.4	44.1	51.4	54.2
Bright steel bars ..	6.3	7.8	7.7	7.9	8.5
Hot-rolled strip ..	21.7	24.1	25.2	25.1	25.9
Cold-rolled strip ..	7.0	8.1	8.1	7.8	8.3
Sheets (incl. coated)	38.8	42.7	41.0	39.1	37.7
Tinplate, terne- and blackplate ..	16.8	17.0	16.4	17.8	16.6
Steel tubes, pipes..	20.0	22.9	20.9	27.4	28.1
Tube, pipe fittings (excl. flanges)	0.4	0.4	0.4	0.4	0.5
Tyres, wheels and axles	4.7	4.8	4.0	4.6	5.1
Forgings (excl. drop forgings) ..	2.6	2.5	2.4	3.0	3.3
Steel castings ..	4.0	4.2	4.3	4.5	5.0
Tool and magnet steel	0.2	0.3	0.2	0.3	0.3
Total	298.7	320.6	306.7	338.7	339.1
Alloy steel	13.2	15.3	14.6	17.2	17.6
Total deliveries from U.K. prod.[6] ..	311.9	335.9	321.3	355.9	356.7
Add: Imported finished steel ..	5.0	18.8	14.7	19.2	23.5
	316.9	354.7	336.0	375.1	380.2
Deduct: Intra-industry conversion[7] ..	41.5	50.4	51.2	55.7	56.9
Total of new material	275.4	304.3	284.8	319.4	323.3

TABLE IV.— *Production of Pig-iron and Ferro-alloys during July* 1956.

District	Fur. naces in blast.	Hema-tite.	Basic.	Foun-dry.	Forge.	Ferro-alloys.	Total.
Derby., Leics., Notts., Northants and Essex	27	—	24.2	23.7	0.8	—	48.7
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	7	—	17.5	—	—	1.5	19.0
Yorkshire (excl. N.E. Coast and Sheffield) ..							
Lincolnshire ..	9	—	32.4	—	—	—	32.4
North-East Coast	19	4.3	46.1	—	—	0.8	51.2
Scotland	9	—	12.5	2.4	—	—	14.9
Staffs., Shrops., Worcs. and Warwick ..	7	—	10.5	1.5	—	—	12.0
South Wales and Mon.	9	3.6	35.0	—	—	—	38.6
Sheffield ..	2	—	3.3	—	—	—	3.3
North-West Coast	9	17.3	1.3	0.1	—	1.5	20.2
Total ..	98	25.2	182.8	27.7	0.8	3.8	240.3
June, 1956 ..	100	30.7	181.6	22.6	1.1	3.6	239.6
July, 1955 ..	98	25.6	172.8	26.9	0.8	4.7	230.8

[1] Used in non-food manufacturing industry.
[2] Weekly average of calendar month.
[3] Stocks, mainly ingots and semi-finished, at the end of the years and months shown.
[4] Five weeks, all tables.
[5] Other than for conversion into any other form of finished steel listed
[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel
[7] Material for conversion into other products also listed in this table.



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- Supin 62 does not adversely affect the bond properties of Sodium Silicate.
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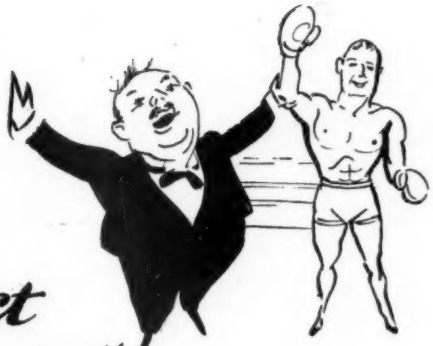

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Raw Material Markets

Iron and Steel

Production of pig-iron is maintained and the furnaces are able to satisfy without much difficulty the requirements of all foundry users. Steelworks' needs of basic pig-iron remain at a high level. Consumption of pig-iron in the melting furnaces recently has necessitated withdrawals from stock and supplies have also to be augmented with imported iron, conditions which are likely to continue until more furnaces are brought in for production of steelmaking iron. The blowing in of furnaces now out of commission for repairs and the new furnaces now nearing completion will add appreciably to present supplies and provide the steelworks with the additional tonnages they need to increase their outputs.

The demand for pig-iron from the foundries appears to be less active. There is a much reduced call for castings from the motor-car industry and foundries concerned are now feeling the full effects of the recession. Other foundries producing high-duty castings are fairly busy, but the overall demand for hematite and the low-phosphorus irons from the engineering and speciality foundries has declined appreciably. Hematite makers, who also send a big tonnage to the steelworks, are having little difficulty in disposing of their outputs, but the supply of low-phosphorus irons is fairly easy and many fresh users have been able to obtain deliveries. The refined irons are in good supply, and makers are able to take on additional orders.

In the light-castings trade, business is quiet and demands from domestic utensil makers and from the building trade show little improvement overall, although some foundries appear to be better employed than others. The jobbing foundries are fairly well occupied, but have capacity available for more work. The supply of high-phosphorus iron appears to be adequate for current usage.

All the foundries are fairly well off for scrap, the biggest demand being for the heavier grades of cast-iron scrap. Foundry coke is coming forward in sufficient quantities for consumption and stock requirements, while ganister, limestone, and firebricks can be obtained on demand.

The re-rollers are comfortably placed for orders and also for steel. Recent imports of steel semis have augmented stocks, and with the deliveries from home steelworks good supplies are on hand.

Non-ferrous Metals

Non-ferrous metal markets are quiet. The Suez crisis still overhangs the market, but, in the absence of any startling news, prices are more responsive to supply and demand considerations than previously. Copper in London after its sharp drop has settled around the £300 per ton level. Demand is fair, with the undertone firm. Stocks of refined copper in LME official warehouses at September 22 totalled 5,740 tons, an advance on the previous week of 224 tons. In the United States the producers' price remains at 40 cents and the Custom smelters' quotation at 39 cents, with No. 2 scrap on offer at 32 cents per lb. Although demand from Detroit has not increased to the extent it was previously hoped, fabricators' figures for August show a marked increase in orders booked compared with July. Nevertheless, production still exceeds consumption, and output from the American mines in Chile is increasing. On the Copperbelt all the mines, with the exception of Roan Antelope, are working normally.

Tin is quietly steady, with the price showing narrow fluctuations around £800 per ton. In theory the international tin agreement is now operative, but the buffer stock has no tin as yet with which to affect the market. Demand for tin on the other side of the Atlantic is quietly steady, with the accent still on spot supplies.

Lead continues to be a good market in London and strong in the United States, where business is being transacted at 16 cents per lb. In August, shipments of lead to US consumers were the largest for any month since January. Stocks at the end of August dropped to 39,304 tons from 49,413 tons at the end of July, the smallest since the beginning of this year.

Zinc continues firm both here and in New York. In the States, August deliveries jumped to 70,709 tons, compared with only 34,219 tons in July, which, of course, was affected by the cutback in automobile production and the steel strike. The strength of the demand for "Prime Western" at 13¼ cents per lb. East St. Louis is good, with the galvanizing trade absorbing sizeable quantities of the metal. But the expected revival of buying of a special high grade has yet to make its appearance.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* September 20, £296 10s. to £297 10s.; September 21, £298 to £298 10s.; September 24, £299 to £299 10s.; September 25, £298 10s. to £299; September 26, £292 to £293.

Three Months: September 20, £295 10s. to £296; September 21, £296 10s. to £297; September 24, £298 to £299; September 25, £297 10s. to £298; September 26, £291 to £292.

TIN, Standard—*Cash:* September 20, £794 to £795; September 21, £798 to £799; September 24, £797 to £798; September 25, £794 to £795; September 26, £783 to £784.

Three Months: September 20, £784 to £785; September 21, £786 to £787; September 24, £784 to £786; September 25, £781 to £782; September 26, £770 to £772.

LEAD—*Second half September:* September 20, £116 15s. to £117; September 21, £116 15s. to £117; September 24, £117 to £117 5s.; September 25, £116 15s. to £117; September 26, £116 to £116 10s.

Second half December: September 20, £114 15s. to £115; September 21, £114 15s. to £115; September 24, £115 to £115 5s.; September 25, £114 15s. to £115; September 26, £114 5s. to £114 10s.

ZINC—*Second half September:* September 20, £96 to £96 10s.; September 21, £96 15s. to £97; September 24, £96 15s. to £97 5s.; September 25, £96 10s. to £96 15s.; September 26, £96 10s. to £97.

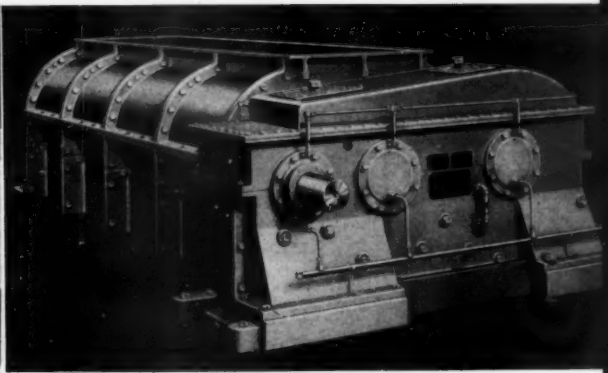
Second half December: September 20, £94 5s. to £94 10s.; September 21, £94 10s. to £94 15s.; September 24, £94 10s. to £95; September 25, £94 5s. to £94 10s.; September 26, £94 5s. to £94 10s.

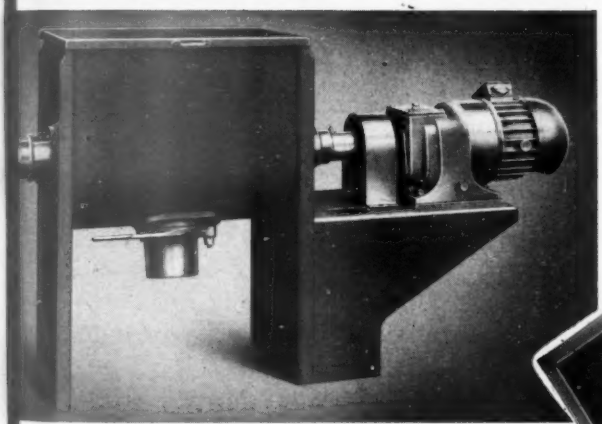
Latest Foundry Statistics

According to the British Bureau of Non-Ferrous Metal Statistics, the output of copper-alloy castings during July, 5,904 tons, was somewhat below the monthly average for the year, but still a little above last year's average.

As stated by the Iron and Steel Board, the weekly average output of steel castings during July was provisionally fixed at 5,900 tons, some 500 tons less than the June figure, but 1,200 tons greater than July, 1955. It is reported that for the week ending July 7, there were employed in this industry 20,010 workpeople, that is 150 fewer than in June, but 110 more than a year ago.

Batch and Continuous Sand Mixers





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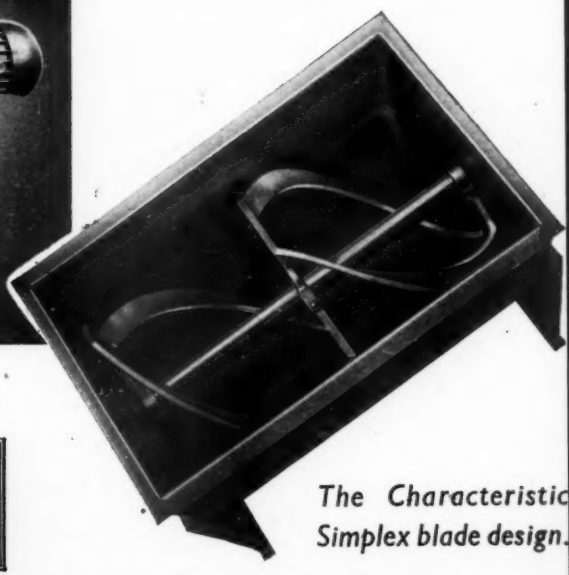
As made and installed by Baker Perkins, U.S.A. in America's largest foundries.

Built in standard sizes with continuous outputs of 6 tons to 120 tons per hour of thoroughly aerated and homogeneously mixed moulding sand.



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The Characteristic Simplex blade design.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

September 26, 1956

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £17 11s. 0d.; Birmingham, £17 3s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £20 8s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £20 12s. 3d.

Scotch Iron.—No. 3 foundry, £21 14s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £23 16s. 6d.; South Zone, £23 19s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £25 4s. 0d.; South Zone, £25 6s. 6d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. of England (local iron), £21 7s. 6d.; Scotland (Scotch iron), Zone S. 1, £21 14s. 0d.; Sheffield, £22 14s. 6d.; Birmingham, £23 2s. 0d.; Wales (Welsh iron), £21 7s. 6d.

Basic Pig-iron.—£18 3s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £48 0s. 0d. to £50 5s. 0d., scale 16s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £73 2s. 6d., scale 16s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 27s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £250 0s. 0d.; 38/40 per cent., £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 16s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 19s. 7d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent.C, £93 10s.0d. to £95 0s. 0d., basis 60 per cent. Cr, scale 29s. 9d. to 32s. 0d. per unit; over 6 per cent. C, £92 10s. 0d. to £93 0s. 0d., basis 60 per cent. Cr, scale 29s. 9d. to 32s. 0d. per unit; 2 per cent. C,* 2s. 1d. per lb. Cr; 1 per cent. C,* 2s. 1½d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £249 0s. 0d.; 96/98 per cent., £259 0s. 0d. to £265 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 6d. to 23s. 6d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £66 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £28 19s. 0d.; tested, 0.08 to 0.25 per cent. C, £29 19s. 0d.; hard (0.41 to 0.60 per cent. C), £31 0s. 6d.; silico-manganese, £39 10s. 0d.; free-cutting, £33 3s. 0d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £36 14s. 6d., silico-manganese, £39 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £34 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £35 16s. 0d.; acid, up to 0.25 per cent. C, £38 17s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £35 7s. 0d.; boiler plates (N.-E. Coast), £37 17s. 0d.; floor plates (N.-E. Coast), £36 16s. 0d.; sectional material, N.-E. Coast, £33 16s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested (4-ton lots), £36 3s. 0d.; flats, 5 in. wide and under (4-ton lots), £36 3s. 0d.; hoop and strip, £36 12s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g. £38 16s. 0d.; black sheets (hand mill), 17/20 g., £50 4s. 6d. galvanized corrugated sheets, 24 g., £62 2s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £61 13s. 9d.; nickel-chrome, £85 10s. 6d.; nickel-chrome-molybdenum, £96 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £292 0s. 0d. to £293 0s. 0d.; three months, £291 0s. 0d. to £292 0s. 0d.; settlement, £293 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 11½d. per lb.; rods, 347s. 6d. per cwt. basis: 20 s.w.g., 380s. 9d. per cwt.

Tin.—Cash, £783 0s. 0d. to £784 0s. 0d.; three months, £770 0s. 0d. to £772 0s. 0d.; settlement, £784 0s. 0d.

Lead (Refined Pig).—Second half September, £116 0s. 0d. to £116 10s. 0d.; second half December, £114 5s. 0d. to £114 10s. 0d.

Zinc.—Second half September, £96 10s. 0d. to £97 0s. 0d.; second half December, £94 5s. 0d. to £94 10s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £128 10s. 0d.; rolled zinc (boiler plates), all English destinations, £126 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £110.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 5½d. per lb.; rods, drawn, 3s. 3¾d.; sheets to 10 w.g., 315s. 9d. per cwt.; wire, 3s. 1½d.; rolled metal, 310s. 9d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £203; B6 (85/15), £270; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £258; HTB2 (38 tons), —; HTB3 (48 tons), —

Gunmetal.—BS RCH, —; BS1400, LG2 (85/5/5/5), £273; LG3 (86/7/5/2), £284; G1 (88/10/2/½), £340; (88/10/2/1), £330.

Phosphor Bronze.—BS1400, PB1 (AID released), £350 per ton.

Phosphor Bronze Strip, etc.—Strip, 451s. 3d. per cwt.; sheets to 10 w.g., 475s. 9d. per cwt.; wire, 4s. 7½d. per lb.; rods, 3s. 11½d.; tubes, 3s. 9½d.; chill cast bars: solids 3s. 10½d., cored 3s. 11½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 1d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 4d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £83 10s. 0d. Nickel, £519 0s. 0d. Aluminium ingots, £198 10s. 0d.; aluminium bronze (BS1400), AB1, £300; AB2, £302. Solder, brazing, BS1945, type 8 (50/50), 3s. 1½d. per lb., type 9 (54/46), 3s. 5d. per lb.

* Average 68–70 per cent.